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(54)【発明の名称】ポリエーテルシロキサンコポリマー網目構造組成物を用いた化粧品組成物

(57)【要約】
$M_aM^H_bM^E_cD_dD^H_eD^E_fT_gT^H_hT^E_iQ_j$の反応生成物を含む組成物。ここで、$M=R^1R^2R^3SiO_{1/2}$、$M^H=R^4R^5HSiO_{1/2}$、$M^E=R^6R^7R^ESiO_{1/2}$、$D=R^8R^9SiO_{2/2}$、$D^H=R^{10}HSiO_{2/2}$、$D^E=R^{11}R^ESiO_{2/2}$、$T=R^{12}SiO_{3/2}$、$T^H=HSiO_{3/2}$、$T^E=R^ESiO_{3/2}$、$Q=SiO_{4/2}$であり、$R^1$、$R^2$、$R^3$、$R^8$、$R^9$及び$R^{12}$は独立に炭素原子数１～６０の一価炭化水素基であり、R^4、R^5及びR^{10}は独立に炭素原子数１～６０の一価炭化水素基、又は水素であり、R^6、R^7及びR^{11}は独立に炭素原子数１～６０の一価炭化水素基、又はR^Eであり、各R^Eは独立に炭素原子数１～６０の１以上のオキシラン部分を有する一価炭化水素基であり、化学量論的添字ａ、ｂ、ｃ、ｄ、ｅ、ｆ、ｇ、ｈ、ｉ及びｊはゼロ又は正であるが、$a+b+c>1$、$b+e+h>1$、$c+f+i>1$、$b+e+h>c+f+i$であり、また$d+e+f+g+h+i+j=0$のときは$a+b+c=2$であることを条件とする。好ましい実施形態において、本発明の反応生成物はポリエーテルシロキサンコポリマー網目構造である。別の好ましい実施形態において、本発明の反応生成物は、揮発性の低分子量ケイ素含有化合物で膨潤可能なポリエーテルシロキサンコポリマー網目構造である。これらの組成物は各種パーソナルケア組成物に有用である。

【特許請求の範囲】

【請求項１】

次式の反応生成物を含んでなる化粧品組成物。

$M_{a}M^{H}_{b}M^{E}_{c}D_{d}D^{H}_{e}D^{E}_{f}T_{g}T^{H}_{h}T^{E}_{i}Q_{j}$

式中、

$M=R^{1}R^{2}R^{3}SiO_{1/2}$、

$M^{H}=R^{4}R^{5}HSiO_{1/2}$、

$M^{E}=R^{6}R^{7}R^{E}SiO_{1/2}$、

$D=R^{8}R^{9}SiO_{2/2}$、

$D^{H}=R^{10}HSiO_{2/2}$、

$D^{E}=R^{11}R^{E}SiO_{2/2}$、

$T=R^{12}SiO_{3/2}$、

$T^{H}=HSiO_{3/2}$、

$T^{E}=R^{E}SiO_{3/2}$、

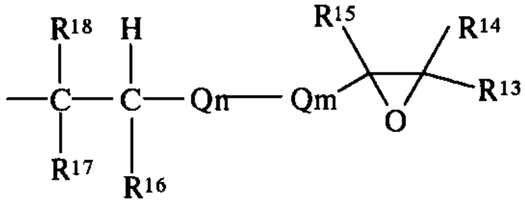
$Q=SiO_{4/2}$であり、

R^{1}、R^{2}、R^{3}、R^{8}、R^{9}及びR^{12}は独立に炭素原子数１～６０の一価炭化水素基であり、R^{4}、R^{5}及びR^{10}は独立に炭素原子数１～６０の一価炭化水素基又は水素であり、R^{6}、R^{7}及びR^{11}は独立に炭素原子数１～６０の一価炭化水素基又はR^{E}であり、各R^{E}は独立に炭素原子数１～６０の１以上のオキシラン部分を有する一価炭化水素基であり、化学量論的添字ａ、ｂ、ｃ、ｄ、ｅ、ｆ、ｇ、ｈ、ｉ及びｊはゼロ又は正の数であるが、$a+b+c>1$、$b+e+h>1$、$c+f+i>1$、$b+e+h>c+f+i$であり、$d+e+f+g+h+i+j=0$のときは$a+b+c=2$であることを条件とする。

【請求項２】

R^{E}が次式を有する、請求項１記載の組成物。

【化１】



式中、R^{13}、R^{14}、R^{15}、R^{16}、R^{17}及びR^{18}は各々独立に水素及び炭素原子数１～６０の一価炭化水素基からなる群から選択され、Q_{m}は炭素原子数１～６０の二価又は三価炭化水素基であり、Q_{n}は炭素原子数１～６０の二価炭化水素基であり、添字ｍ及びｎは独立に０又は１であるが、Q_{m}が三価のときはR^{13}又はR^{14}の一方が存在しないことを条件とする。

【請求項３】

R^{E}が４－ビニルシクロヘキセンオキシド、アリルグリシジルエーテル、リモネンオキシド、１，２－エポキシ－５－ヘキセン、１，２－エポキシ－７－オクテン、ノルボルナジエンモノエポキシド及び１，２－エポキシ－９－デセンからなる群から選択される、請求項１記載の組成物。

【請求項４】

R^{13}、R^{14}、R^{15}、R^{16}、R^{17}及びR^{18}が水素であり、ｍ及びｎが０である、請求項２記載の組成物。

【請求項５】

R^{E}が４－ビニルシクロヘキセンオキシドである、請求項３記載の組成物。

【請求項６】

R^{1}、R^{2}、R^{3}、R^{8}、R^{9}及びR^{12}が独立にメチル、エチル、ｓｅｃ－ブチル、ｔｅｒｔ－ブチル、オクチル、デシル、ドデシル、セチル、ステアリル、エテニル、プロペニル、ブチニル、ヒドロキシプロピル、ブトキシ、２，５，８－トリオキサデカニル、カルボキ

シメチル、クロロメチル、Ｃ３０＋及び３，３，３－フルオロプロピルからなる群から選択される、請求項１記載の組成物。

【請求項７】

R^1、R^2、R^3、R^8、R^9及びR^{12}が独立にメチル、エチル、ｓｅｃ－ブチル、ｔｅｒｔ－ブチル、オクチル、デシル、ドデシル、セチル、ステアリル、エテニル、プロペニル、ブチニル、ヒドロキシプロピル、シアノエチル、ブトキシ、２，５，８－トリオキサデカニル、カルボキシメチル、クロロメチル及び３，３，３－フルオロプロピルからなる群から選択される、請求項２記載の組成物。

【請求項８】

R^1、R^2、R^3、R^8、R^9及びR^{12}が独立にメチル、エチル、ｓｅｃ－ブチル、ｔｅｒｔ－ブチル、オクチル、デシル、ドデシル、セチル、ステアリル、エテニル、プロペニル、ブチニル、ヒドロキシプロピル、シアノエチル、ブトキシ、２，５，８－トリオキサデカニル、カルボキシメチル、クロロメチル及び３，３，３－フルオロプロピルからなる群から選択される、請求項３記載の組成物。

【請求項９】

R^1、R^2、R^3、R^8、R^9及びR^{12}が独立にメチル、エチル、ｓｅｃ－ブチル、ｔｅｒｔ－ブチル、オクチル、デシル、ドデシル、セチル、ステアリル、エテニル、プロペニル、ブチニル、ヒドロキシプロピル、シアノエチル、ブトキシ、２，５，８－トリオキサデカニル、カルボキシメチル、クロロメチル及び３，３，３－フルオロプロピルからなる群から選択される、請求項４記載の組成物。

【請求項１０】

R^1、R^2、R^3、R^8、R^9及びR^{12}が独立にメチル、エチル、ｓｅｃ－ブチル、ｔｅｒｔ－ブチル、オクチル、デシル、ドデシル、セチル、ステアリル、エテニル、プロペニル、ブチニル、ヒドロキシプロピル、シアノエチル、ブトキシ、２，５，８－トリオキサデカニル、カルボキシメチル、クロロメチル及び３，３，３－フルオロプロピルからなる群から選択される、請求項５記載の組成物。

【請求項１１】

水性エマルジョンを含んでなる化粧品組成物であって、不連続相が水を含み、連続相が次式の反応生成物を含有する組成物を含む、化粧品組成物。

$M_aM^H_bM^E_cD_dD^H_eD^E_fT_gT^H_hT^E_iQ_j$

式中、

$M=R^1R^2R^3SiO_{1/2}$、

$M^H=R^4R^5HSiO_{1/2}$、

$M^E=R^6R^7R^ESiO_{1/2}$、

$D=R^8R^9SiO_{2/2}$、

$D^H=R^{10}HSiO_{2/2}$、

$D^E=R^{11}R^ESiO_{2/2}$、

$T=R^{12}SiO_{3/2}$、

$T^H=HSiO_{3/2}$、

$T^E=R^ESiO_{3/2}$、

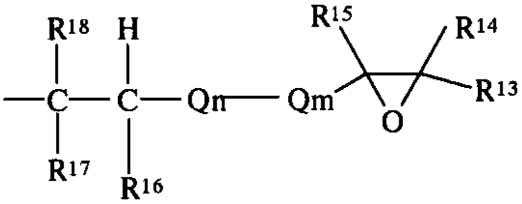
$Q=SiO_{4/2}$であり、

R^1、R^2、R^3、R^8、R^9及びR^{12}は独立に炭素原子数１～６０の一価炭化水素基であり、R^4、R^5及びR^{10}は独立に炭素原子数１～６０の一価炭化水素基又は水素であり、R^6、R^7及びR^{11}は独立に炭素原子数１～６０の一価炭化水素基又はR^Eであり、各R^Eは独立に炭素原子数１～６０の１以上のオキシラン部分を有する一価炭化水素基であり、化学量論的添字ａ、ｂ、ｃ、ｄ、ｅ、ｆ、ｇ、ｈ、ｉ及びｊはゼロ又は正の数であるが、$a+b+c>1$、$b+e+h>1$、$c+f+i>1$、$b+e+h>c+f+i$であり、$d+e+f+g+h+i+j=0$のときは$a+b+c=2$であることを条件とする。

【請求項１２】

R^Eが次式を有する、請求項１１記載の組成物。

【化２】



式中、R^{13}、R^{14}、R^{15}、R^{16}、R^{17}及びR^{18}は各々独立に水素及び炭素原子数１～６０の一価炭化水素基からなる群から選択され、Q_mは炭素原子数１～６０の二価又は三価炭化水素基であり、Q_nは炭素原子数１～６０の二価炭化水素基であり、添字ｍ及びｎは独立に０又は１であるが、Q_mが三価のときはR^{13}又はR^{14}の一方が存在しないことを条件とする。

【請求項１３】

R^Eが４－ビニルシクロヘキセンオキシド、アリルグリシジルエーテル、リモネンオキシド、１，２－エポキシ－５－ヘキセン、１，２－エポキシ－７－オクテン、ノルボルナジエンモノエポキシド及び１，２－エポキシ－９－デセンからなる群から選択される、請求項１１記載の組成物。

【請求項１４】

R^{13}、R^{14}、R^{15}、R^{16}、R^{17}及びR^{18}が水素であり、ｍ及びｎが０である、請求項１２記載の組成物。

【請求項１５】

R^Eが４－ビニルシクロヘキセンオキシドである、請求項１３記載の組成物。

【請求項１６】

R^1、R^2、R^3、R^8、R^9及びR^{12}が独立にメチル、エチル、ｓｅｃ－ブチル、ｔｅｒｔ－ブチル、オクチル、デシル、ドデシル、セチル、ステアリル、エテニル、プロペニル、ブチニル、ヒドロキシプロピル、ブトキシ、２，５，８－トリオキサデカニル、カルボキシメチル、クロロメチル、Ｃ３０＋及び３，３，３－フルオロプロピルからなる群から選択される、請求項１１記載の組成物。

【請求項１７】

R^1、R^2、R^3、R^8、R^9及びR^{12}が独立にメチル、エチル、ｓｅｃ－ブチル、ｔｅｒｔ－ブチル、オクチル、デシル、ドデシル、セチル、ステアリル、エテニル、プロペニル、ブチニル、ヒドロキシプロピル、シアノエチル、ブトキシ、２，５，８－トリオキサデカニル、カルボキシメチル、クロロメチル及び３，３，３－フルオロプロピルからなる群から選択される、請求項１２記載の組成物。

【請求項１８】

R^1、R^2、R^3、R^8、R^9及びR^{12}が独立にメチル、エチル、ｓｅｃ－ブチル、ｔｅｒｔ－ブチル、オクチル、デシル、ドデシル、セチル、ステアリル、エテニル、プロペニル、ブチニル、ヒドロキシプロピル、シアノエチル、ブトキシ、２，５，８－トリオキサデカニル、カルボキシメチル、クロロメチル及び３，３，３－フルオロプロピルからなる群から選択される、請求項１３記載の組成物。

【請求項１９】

R^1、R^2、R^3、R^8、R^9及びR^{12}が独立にメチル、エチル、ｓｅｃ－ブチル、ｔｅｒｔ－ブチル、オクチル、デシル、ドデシル、セチル、ステアリル、エテニル、プロペニル、ブチニル、ヒドロキシプロピル、シアノエチル、ブトキシ、２，５，８－トリオキサデカニル、カルボキシメチル、クロロメチル及び３，３，３－フルオロプロピルからなる群から選択される、請求項１４記載の組成物。

【請求項２０】

R^1、R^2、R^3、R^8、R^9及びR^{12}が独立にメチル、エチル、ｓｅｃ－ブチル、ｔｅｒｔ－ブチル、オクチル、デシル、ドデシル、セチル、ステアリル、エテニル、プロペニル、ブチニル、ヒドロキシプロピル、シアノエチル、ブトキシ、２，５，８－トリオキサデカ

ニル、カルボキシメチル、クロロメチル及び３，３，３－フルオロプロピルからなる群から選択される、請求項１５記載の組成物。

【請求項２１】

水性エマルジョンを含んでなる化粧品組成物であって、不連続相が水を含み、連続相が次式の反応生成物を含有する組成物を含む、化粧品組成物。

$M_aM^H_bM^E_cD_dD^H_eD^E_fT_gT^H_hT^E_iQ_j$

式中、

$M=R^1R^2R^3SiO_{1/2}$、

$M^H=R^4R^5HSiO_{1/2}$、

$M^E=R^6R^7R^ESiO_{1/2}$、

$D=R^8R^9SiO_{2/2}$、

$D^H=R^{10}HSiO_{2/2}$、

$D^E=R^{11}R^ESiO_{2/2}$、

$T=R^{12}SiO_{3/2}$、

$T^H=HSiO_{3/2}$、

$T^E=R^ESiO_{3/2}$、

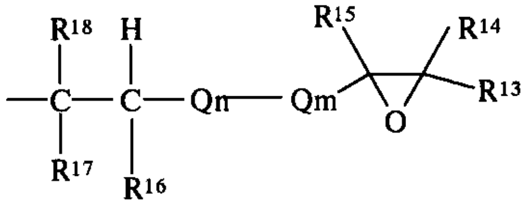
$Q=SiO_{4/2}$であり、

R^1、R^2、R^3、R^8、R^9及びR^{12}は独立に炭素原子数１～６０の一価炭化水素基であり、R^4、R^5及びR^{10}は独立に炭素原子数１～６０の一価炭化水素基又は水素であり、R^6、R^7及びR^{11}は独立に炭素原子数１～６０の一価炭化水素基又はR^Eであり、各R^Eは独立に炭素原子数１～６０の１以上のオキシラン部分を有する一価炭化水素基であり、化学量論的添字ａ、ｂ、ｃ、ｄ、ｅ、ｆ、ｇ、ｈ、ｉ及びｊはゼロ又は正の数であるが、$a+b+c>1$、$b+e+h>1$、$c+f+i>1$、$b+e+h>c+f+i$であり、$d+e+f+g+h+i+j=0$のときは$a+b+c=2$であることを条件とする。

【請求項２２】

R^Eが次式を有する、請求項２１記載の組成物。

【化３】



式中、R^{13}、R^{14}、R^{15}、R^{16}、R^{17}及びR^{18}は各々独立に水素及び炭素原子数１～６０の一価炭化水素基からなる群から選択され、Q_mは炭素原子数１～６０の二価又は三価炭化水素基であり、Q_nは炭素原子数１～６０の二価炭化水素基であり、添字ｍ及びｎは独立に０又は１であるが、Q_mが三価のときはR^{13}又はR^{14}の一方が存在しないことを条件とする。

【請求項２３】

R^Eが４－ビニルシクロヘキセンオキシド、アリルグリシジルエーテル、リモネンオキシド、１，２－エポキシ－５－ヘキセン、１，２－エポキシ－７－オクテン、ノルボルナジエンモノエポキシド及び１，２－エポキシ－９－デセンからなる群から選択される、請求項２１記載の組成物。

【請求項２４】

R^{13}、R^{14}、R^{15}、R^{16}、R^{17}及びR^{18}が水素であり、ｍ及びｎが０である、請求項２２記載の組成物。

【請求項２５】

R^Eが４－ビニルシクロヘキセンオキシドである、請求項２３記載の組成物。

【請求項２６】

R^1、R^2、R^3、R^8、R^9及びR^{12}が独立にメチル、エチル、ｓｅｃ－ブチル、ｔｅｒｔ

－ブチル、オクチル、デシル、ドデシル、セチル、ステアリル、エテニル、プロペニル、ブチニル、ヒドロキシプロピル、シアノエチル、ブトキシ、２，５，８－トリオキサデカニル、カルボキシメチル、クロロメチル、Ｃ３０＋及び３，３，３－フルオロプロピルからなる群から選択される、請求項２１記載の組成物。

【請求項２７】

R^1、R^2、R^3、R^8、R^9及びR^{12}が独立にメチル、エチル、ｓｅｃ－ブチル、ｔｅｒｔ－ブチル、オクチル、デシル、ドデシル、セチル、ステアリル、エテニル、プロペニル、ブチニル、ヒドロキシプロピル、ブトキシ、２，５，８－トリオキサデカニル、カルボキシメチル、クロロメチル及び３，３，３－フルオロプロピルからなる群から選択される、請求項２２記載の組成物。

【請求項２８】

R^1、R^2、R^3、R^8、R^9及びR^{12}が独立にメチル、エチル、ｓｅｃ－ブチル、ｔｅｒｔ－ブチル、オクチル、デシル、ドデシル、セチル、ステアリル、エテニル、プロペニル、ブチニル、ヒドロキシプロピル、シアノエチル、ブトキシ、２，５，８－トリオキサデカニル、カルボキシメチル、クロロメチル及び３，３，３－フルオロプロピルからなる群から選択される、請求項２３記載の組成物。

【請求項２９】

R^1、R^2、R^3、R^8、R^9及びR^{12}が独立にメチル、エチル、ｓｅｃ－ブチル、ｔｅｒｔ－ブチル、オクチル、デシル、ドデシル、セチル、ステアリル、エテニル、プロペニル、ブチニル、ヒドロキシプロピル、シアノエチル、ブトキシ、２，５，８－トリオキサデカニル、カルボキシメチル、クロロメチル及び３，３，３－フルオロプロピルからなる群から選択される、請求項２４記載の組成物。

【請求項３０】

R^1、R^2、R^3、R^8、R^9及びR^{12}が独立にメチル、エチル、ｓｅｃ－ブチル、ｔｅｒｔ－ブチル、オクチル、デシル、ドデシル、セチル、ステアリル、エテニル、プロペニル、ブチニル、ヒドロキシプロピル、シアノエチル、ブトキシ、２，５，８－トリオキサデカニル、カルボキシメチル、クロロメチル及び３，３，３－フルオロプロピルからなる群から選択される、請求項２５記載の組成物。

【請求項３１】

非水性エマルジョンを含んでなる化粧品組成物であって、不連続相が非水性ヒドロキシル溶媒を含み、連続相が次式の反応生成物を含有する組成物を含む、化粧品組成物。

$M_a M^H_b M^E_c D_d D^H_e D^E_f T_g T^H_h T^E_i Q_j$

式中、

$M = R^1 R^2 R^3 SiO_{1/2}$、

$M^H = R^4 R^5 HSiO_{1/2}$、

$M^E = R^6 R^7 R^E SiO_{1/2}$、

$D = R^8 R^9 SiO_{2/2}$、

$D^H = R^{10} HSiO_{2/2}$、

$D^E = R^{11} R^E SiO_{2/2}$、

$T = R^{12} SiO_{3/2}$、

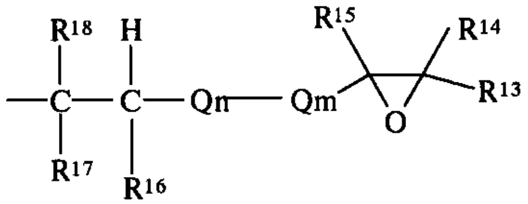
$T^H = HSiO_{3/2}$、

$T^E = R^E SiO_{3/2}$、

$Q = SiO_{4/2}$であり、

R^1、R^2、R^3、R^8、R^9及びR^{12}は独立に炭素原子数１～６０の一価炭化水素基であり、R^4、R^5及びR^{10}は独立に炭素原子数１～６０の一価炭化水素基又は水素であり、R^6、R^7及びR^{11}は独立に炭素原子数１～６０の一価炭化水素基又はR^Eであり、各R^Eは独立に炭素原子数１～６０の１以上のオキシラン部分を有する一価炭化水素基であり、化学量論的添字ａ、ｂ、ｃ、ｄ、ｅ、ｆ、ｇ、ｈ、ｉ及びｊはゼロ又は正の数であるが、$a+b+c>1$、$b+e+h>1$、$c+f+i>1$、$b+e+h>c+f+i$であり、$d+e+f+g+h+i+j=0$のときは$a+b+c=2$であることを条件とする。

【請求項３２】
R^Eが次式を有する、請求項３１記載の組成物。
【化４】



式中、R^{13}、R^{14}、R^{15}、R^{16}、R^{17}及びR^{18}は各々独立に水素及び炭素原子数１～６０の一価炭化水素基からなる群から選択され、Q_mは炭素原子数１～６０の二価又は三価炭化水素基であり、Q_nは炭素原子数１～６０の二価炭化水素基であり、添字ｍ及びｎは独立に０又は１であるが、Q_mが三価のときはR^{13}又はR^{14}の一方が存在しないことを条件とする。

【請求項３３】
R^Eが４－ビニルシクロヘキセンオキシド、アリルグリシジルエーテル、リモネンオキシド、１，２－エポキシ－５－ヘキセン、１，２－エポキシ－７－オクテン、ノルボルナジエンモノエポキシド及び１，２－エポキシ－９－デセンからなる群から選択される、請求項３１記載の組成物。

【請求項３４】
R^{13}、R^{14}、R^{15}、R^{16}、R^{17}及びR^{18}が水素であり、ｍ及びｎが０である、請求項３２記載の組成物。

【請求項３５】
R^Eが４－ビニルシクロヘキセンオキシドである、請求項３３記載の組成物。

【請求項３６】
R^1、R^2、R^3、R^8、R^9及びR^{12}が独立にメチル、エチル、ｓｅｃ－ブチル、ｔｅｒｔ－ブチル、オクチル、デシル、ドデシル、セチル、ステアリル、エテニル、プロペニル、ブチニル、ヒドロキシプロピル、ブトキシ、２，５，８－トリオキサデカニル、カルボキシメチル、クロロメチル、Ｃ３０＋及び３，３，３－フルオロプロピルからなる群から選択される、請求項３１記載の組成物。

【請求項３７】
R^1、R^2、R^3、R^8、R^9及びR^{12}が独立にメチル、エチル、ｓｅｃ－ブチル、ｔｅｒｔ－ブチル、オクチル、デシル、ドデシル、セチル、ステアリル、エテニル、プロペニル、ブチニル、ヒドロキシプロピル、シアノエチル、ブトキシ、２，５，８－トリオキサデカニル、カルボキシメチル、クロロメチル及び３，３，３－フルオロプロピルからなる群から選択される、請求項３２記載の組成物。

【請求項３８】
R^1、R^2、R^3、R^8、R^9及びR^{12}が独立にメチル、エチル、ｓｅｃ－ブチル、ｔｅｒｔ－ブチル、オクチル、デシル、ドデシル、セチル、ステアリル、エテニル、プロペニル、ブチニル、ヒドロキシプロピル、シアノエチル、ブトキシ、２，５，８－トリオキサデカニル、カルボキシメチル、クロロメチル及び３，３，３－フルオロプロピルからなる群から選択される、請求項３３記載の組成物。

【請求項３９】
R^1、R^2、R^3、R^8、R^9及びR^{12}が独立にメチル、エチル、ｓｅｃ－ブチル、ｔｅｒｔ－ブチル、オクチル、デシル、ドデシル、セチル、ステアリル、エテニル、プロペニル、ブチニル、ヒドロキシプロピル、シアノエチル、ブトキシ、２，５，８－トリオキサデカニル、カルボキシメチル、クロロメチル及び３，３，３－フルオロプロピルからなる群から選択される、請求項３４記載の組成物。

【請求項４０】
R^1、R^2、R^3、R^8、R^9及びR^{12}が独立にメチル、エチル、ｓｅｃ－ブチル、ｔｅｒｔ

ーブチル、オクチル、デシル、ドデシル、セチル、ステアリル、エテニル、プロペニル、ブチニル、ヒドロキシプロピル、シアノエチル、ブトキシ、２，５，８－トリオキサデカニル、カルボキシメチル、クロロメチル及び３，３，３－フルオロプロピルからなる群から選択される、請求項３５記載の組成物。

【請求項４１】

非水性エマルジョンを含んでなる化粧品組成物であって、連続相が非水性ヒドロキシル溶媒を含み、不連続相が次式の反応生成物を含有する組成物を含む、化粧品組成物。

$M_aM^H_bM^E_cD_dD^H_eD^E_fT_gT^H_hT^E_iQ_j$

式中、$M=R^1R^2R^3SiO_{1/2}$、

$M^H=R^4R^5HSiO_{1/2}$、

$M^E=R^6R^7R^ESiO_{1/2}$、

$D=R^8R^9SiO_{2/2}$、

$D^H=R^{10}HSiO_{2/2}$、

$D^E=R^{11}R^ESiO_{2/2}$、

$T=R^{12}SiO_{3/2}$、

$T^H=HSiO_{3/2}$、

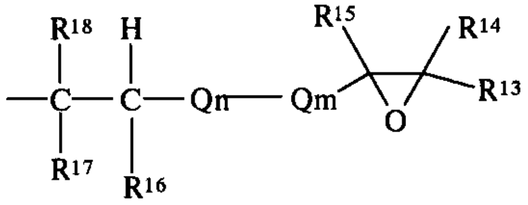
$T^E=R^ESiO_{3/2}$、

$Q=SiO_{4/2}$であり、式中、R^1、R^2、R^3、R^8、R^9及びR^{12}は独立に炭素原子数１～６０の一価炭化水素基であり、R^4、R^5及びR^{10}は独立に炭素原子数１～６０の一価炭化水素基又は水素であり、R^6、R^7及びR^{11}は独立に炭素原子数１～６０の一価炭化水素基又はR^Eであり、各R^Eは独立に炭素原子数１～６０の１以上のオキシラン部分を有する一価炭化水素基であり、化学量論的添字ａ、ｂ、ｃ、ｄ、ｅ、ｆ、ｇ、ｈ、ｉ及びｊはゼロ又は正の数であるが、$a+b+c>1$、$b+e+h>1$、$c+f+i>1$、$b+e+h>c+f+i$であり、$d+e+f+g+h+i+j=0$のときは$a+b+c=2$であることを条件とする。

【請求項４２】

R^Eが次式を有する、請求項４１記載の組成物。

【化５】



式中、R^{13}、R^{14}、R^{15}、R^{16}、R^{17}及びR^{18}は各々独立に水素及び炭素原子数１～６０の一価炭化水素基からなる群から選択され、Q_mは炭素原子数１～６０の二価又は三価炭化水素基であり、Q_nは炭素原子数１～６０の二価炭化水素基であり、添字ｍ及びｎは独立に０又は１であるが、Q_mが三価のときはR^{13}又はR^{14}の一方が存在しないことを条件とする。

【請求項４３】

R^Eが４－ビニルシクロヘキセンオキシド、アリルグリシジルエーテル、リモネンオキシド、１，２－エポキシ－５－ヘキセン、１，２－エポキシ－７－オクテン、ノルボルナジエンモノエポキシド及び１，２－エポキシ－９－デセンからなる群から選択される、請求項４１記載の組成物。

【請求項４４】

R^{13}、R^{14}、R^{15}、R^{16}、R^{17}及びR^{18}が水素であり、ｍ及びｎが０である、請求項４２記載の組成物。

【請求項４５】

R^Eが４－ビニルシクロヘキセンオキシドである、請求項４３記載の組成物。

【請求項４６】

R^1、R^2、R^3、R^8、R^9及びR^{12}が独立にメチル、エチル、ｓｅｃ－ブチル、ｔｅｒｔ－ブチル、オクチル、デシル、ドデシル、セチル、ステアリル、エテニル、プロペニル、ブチニル、ヒドロキシプロピル、ブトキシ、２，５，８－トリオキサデカニル、カルボキシメチル、クロロメチル、Ｃ３０＋及び３，３，３－フルオロプロピルからなる群から選択される、請求項４１記載の組成物。

【請求項４７】

R^1、R^2、R^3、R^8、R^9及びR^{12}が独立にメチル、エチル、ｓｅｃ－ブチル、ｔｅｒｔ－ブチル、オクチル、デシル、ドデシル、セチル、ステアリル、エテニル、プロペニル、ブチニル、ヒドロキシプロピル、シアノエチル、ブトキシ、２，５，８－トリオキサデカニル、カルボキシメチル、クロロメチル及び３，３，３－フルオロプロピルからなる群から選択される、請求項４２記載の組成物。

【請求項４８】

R^1、R^2、R^3、R^8、R^9及びR^{12}が独立にメチル、エチル、ｓｅｃ－ブチル、ｔｅｒｔ－ブチル、オクチル、デシル、ドデシル、セチル、ステアリル、エテニル、プロペニル、ブチニル、ヒドロキシプロピル、シアノエチル、ブトキシ、２，５，８－トリオキサデカニル、カルボキシメチル、クロロメチル及び３，３，３－フルオロプロピルからなる群から選択される、請求項４３記載の組成物。

【請求項４９】

R^1、R^2、R^3、R^8、R^9及びR^{12}が独立にメチル、エチル、ｓｅｃ－ブチル、ｔｅｒｔ－ブチル、オクチル、デシル、ドデシル、セチル、ステアリル、エテニル、プロペニル、ブチニル、ヒドロキシプロピル、シアノエチル、ブトキシ、２，５，８－トリオキサデカニル、カルボキシメチル、クロロメチル及び３，３，３－フルオロプロピルからなる群から選択される、請求項４４記載の組成物。

【請求項５０】

R^1、R^2、R^3、R^8、R^9及びR^{12}が独立にメチル、エチル、ｓｅｃ－ブチル、ｔｅｒｔ－ブチル、オクチル、デシル、ドデシル、セチル、ステアリル、エテニル、プロペニル、ブチニル、ヒドロキシプロピル、シアノエチル、ブトキシ、２，５，８－トリオキサデカニル、カルボキシメチル、クロロメチル及び３，３，３－フルオロプロピルからなる群から選択される、請求項４５記載の組成物。

【請求項５１】

化粧品組成物が、デオドラント、制汗剤、制汗剤・デオドラントの組合せ、シェービング製品、スキンローション、モイスチュアライザー、トナー、浴用製品、クレンジング製品、ヘアケア製品、シャンプー、コンディショナー、ムース、スタイリングジェル、ヘアスプレー、染毛剤、ヘアカラー製品、ヘアブリーチ、ウェービング製品、ヘアストレートナー、マニキュア製品、ネイルポリッシュ、ネイルポリッシュリムーバー、ネイルクリーム、ネイルローション、キューティクルソフトナー、保護クリーム、日焼け止め、虫よけ、老化防止製品、カラーコスメチック、口紅、ファンデーション、白粉、アイライナー、アイシャドー、頬紅、メーキャップ、マスカラ、従来からシリコーン成分が添加されているパーソナルケア製品、及び皮膚に塗布する薬用組成物の局所投与のためのドラッグデリバリーシステムからなる群から選択される、請求項１記載の化粧品組成物。

【請求項５２】

化粧品組成物が、デオドラント、制汗剤、制汗剤・デオドラントの組合せ、シェービング製品、スキンローション、モイスチュアライザー、トナー、浴用製品、クレンジング製品、ヘアケア製品、シャンプー、コンディショナー、ムース、スタイリングジェル、ヘアスプレー、染毛剤、ヘアカラー製品、ヘアブリーチ、ウェービング製品、ヘアストレートナー、マニキュア製品、ネイルポリッシュ、ネイルポリッシュリムーバー、ネイルクリーム、ネイルローション、キューティクルソフトナー、保護クリーム、日焼け止め、虫よけ、老化防止製品、カラーコスメチック、口紅、ファンデーション、白粉、アイライナー、アイシャドー、頬紅、メーキャップ、マスカラ、従来からシリコーン成分が添加されているパーソナルケア製品、及び皮膚に塗布する薬用組成物の局所投与のためのドラッグデリバ

リーシステムからなる群から選択される、請求項１１記載の化粧品組成物。

【請求項５３】

化粧品組成物が、デオドラント、制汗剤、制汗剤・デオドラントの組合せ、シェービング製品、スキンローション、モイスチュアライザー、トナー、浴用製品、クレンジング製品、ヘアケア製品、シャンプー、コンディショナー、ムース、スタイリングジェル、ヘアスプレー、染毛剤、ヘアカラー製品、ヘアブリーチ、ウェービング製品、ヘアストレートナー、マニキュア製品、ネイルポリッシュ、ネイルポリッシュリムーバー、ネイルクリーム、ネイルローション、キューティクルソフトナー、保護クリーム、日焼け止め、虫よけ、老化防止製品、カラーコスメチック、口紅、ファンデーション、白粉、アイライナー、アイシャドー、頬紅、メーキャップ、マスカラ、従来からシリコーン成分が添加されているパーソナルケア製品、及び皮膚に塗布する薬用組成物の局所投与のためのドラッグデリバリーシステムからなる群から選択される、請求項２１記載の化粧品組成物。

【請求項５４】

化粧品組成物が、デオドラント、制汗剤、制汗剤・デオドラントの組合せ、シェービング製品、スキンローション、モイスチュアライザー、トナー、浴用製品、クレンジング製品、ヘアケア製品、シャンプー、コンディショナー、ムース、スタイリングジェル、ヘアスプレー、染毛剤、ヘアカラー製品、ヘアブリーチ、ウェービング製品、ヘアストレートナー、マニキュア製品、ネイルポリッシュ、ネイルポリッシュリムーバー、ネイルクリーム、ネイルローション、キューティクルソフトナー、保護クリーム、日焼け止め、虫よけ、老化防止製品、カラーコスメチック、口紅、ファンデーション、白粉、アイライナー、アイシャドー、頬紅、メーキャップ、マスカラ、従来からシリコーン成分が添加されているパーソナルケア製品、及び皮膚に塗布する薬用組成物の局所投与のためのドラッグデリバリーシステムからなる群から選択される、請求項３１記載の化粧品組成物。

【請求項５５】

化粧品組成物が、デオドラント、制汗剤、制汗剤・デオドラントの組合せ、シェービング製品、スキンローション、モイスチュアライザー、トナー、浴用製品、クレンジング製品、ヘアケア製品、シャンプー、コンディショナー、ムース、スタイリングジェル、ヘアスプレー、染毛剤、ヘアカラー製品、ヘアブリーチ、ウェービング製品、ヘアストレートナー、マニキュア製品、ネイルポリッシュ、ネイルポリッシュリムーバー、ネイルクリーム、ネイルローション、キューティクルソフトナー、保護クリーム、日焼け止め、虫よけ、老化防止製品、カラーコスメチック、口紅、ファンデーション、白粉、アイライナー、アイシャドー、頬紅、メーキャップ、マスカラ、従来からシリコーン成分が添加されているパーソナルケア製品、及び皮膚に塗布する薬用組成物の局所投与のためのドラッグデリバリーシステムからなる群から選択される、請求項４１記載の化粧品組成物。

【発明の詳細な説明】

【技術分野】

【０００１】

本発明は、シリコーン組成物に関し、具体的には、エポキシド又はオキシラン部分から誘導された架橋を含むシリコーンポリマー網目構造を含んでなる組成物に関する。

【背景技術】

【０００２】

パーソナルケア産業は、各々が最終配合に対して重要又は望ましい性能特性を有する幾つかの成分の混合物に基づく多種多様な性能の製品を送達することができるということで発展している。一つの望ましい特性は、高粘度であるが剪断で低減し得る粘度を維持しながら、例えばオクタメチルシクロテトラシロキサンやデカメチルシクロペンタシロキサンのような低分子量シリコーンに由来するシルキーな初期感触を配合物に与えることができる能力である。こうした低分子量のシリコーンは所望の感触特性を与えるが、低粘度で極めて流動性の液体でもある。したがって、これらを配合物中に保持しておくのは容易でなく、むしろ分離したり、所定の容器から流れ出したり、特定の用途に用いたときに皮膚の上で制御できずに流れてしまう傾向がある。さらに、拭いて乾かしたときに滑らかな低残渣

感が得られるようにしながら初期のシルキーな感触を達成するのが望ましい。揮発性シリコーン中で調製した高分子シリコーンゲルは、揮発性低粘度シリコーンの望ましい初期感触を配合物に付与すると同時に高い粘度と乾燥時に滑らかでシルキーな感触を与えることが見出されている。例えば、米国特許第５７６０１１６号、同第５４９３０４１号及び同第４９８７１６９号を参照されたい。

【０００３】

かかる高分子シリコーンゲルは通例ヒドロシリル化反応によって製造されているが、それにはＳｉＨ官能基と末端オレフィン性基とを併用して架橋シロキサンポリマーを形成する必要がある。したがって、これらの物質の製造に利用できるのは、シリルヒドリド基及び任意にはビニル官能性シロキサン基を組み込むことができるシロキサン構造だけである。さらに、この架橋シロキサンポリマー製造方法では、複雑な配合品に追加の有利な性能を付与するためにポリマー構造中に組み込むことができる望ましい有機官能基の範囲が限られている。したがって、架橋シロキサンポリマー中に有機官能基を組み込む試みでは、ヒドロシリル化反応と適合し得る不飽和有機基が用いられる。

【特許文献１】

米国特許第５７６０１１６号

【特許文献２】

米国特許第５４９３０４１号

【特許文献３】

米国特許第４９８７１６９号

【発明の開示】

【課題を解決するための手段】

【０００４】

化粧品組成物は次式の反応生成物を含んでなる。

$M_aM^H_bM^E_cD_dD^H_eD^E_fT_gT^H_hT^E_iQ_j$

式中、

$M = R^1R^2R^3SiO_{1/2}$、

$M^H = R^4R^5HSiO_{1/2}$、

$M^E = R^6R^7R^ESiO_{1/2}$、

$D = R^8R^9SiO_{2/2}$、

$D^H = R^{10}HSiO_{2/2}$、

$D^E = R^{11}R^ESiO_{2/2}$、

$T = R^{12}SiO_{3/2}$、

$T^H = HSiO_{3/2}$、

$T^E = R^ESiO_{3/2}$、

$Q = SiO_{4/2}$

であり、R^1、R^2、R^3、R^8、R^9及びR^{12}は独立に炭素原子数１～６０の一価炭化水素基であり、R^4、R^5及びR^{10}は独立に炭素原子数１～６０の一価炭化水素基又は水素であり、R^6、R^7、R^{11}は独立に炭素原子数１～６０の一価炭化水素基又はR^Eであり、各R^Eは独立に炭素原子数１～６０の１以上のオキシラン部分を有する一価炭化水素基であり、化学量論的添字ａ、ｂ、ｃ、ｄ、ｅ、ｆ、ｇ、ｈ、ｉ及びｊはゼロ又は正の数であるが、$a+b+c>1$、$b+e+h>1$、$c+f+i>1$、$b+e+h>c+f+i$であり、かつ$d+e+f+g+h+i+j=0$のときは$a+b+c=2$であることを条件とする。好ましい実施形態では、本発明の反応生成物はポリエーテルシロキサンコポリマー網目構造である。別の好ましい実施形態では、本発明の反応生成物は揮発性低分子量含ケイ素化合物で膨潤したポリエーテルシロキサンコポリマー網目構造である。これらの組成物は各種パーソナルケア組成物に有用である。

【発明を実施するための最良の形態】

【０００５】

本発明の組成物は、次式のエポキシ官能性ヒドリドシロキサン分子の反応生成物からなる

。

$M_aM^H_bM^E_cD_dD^H_eD^E_fT_gT^H_hT^E_iQ_j$

式中、

$M=R^1R^2R^3SiO_{1/2}$、

$M^H=R^4R^5HSiO_{1/2}$、

$M^E=R^6R^7R^ESiO_{1/2}$、

$D=R^8R^9SiO_{2/2}$、

$D^H=R^{10}HSiO_{2/2}$、

$D^E=R^{11}R^ESiO_{2/2}$、

$T=R^{12}SiO_{3/2}$、

$T^H=HSiO_{3/2}$、

$T^E=R^ESiO_{3/2}$、

$Q=SiO_{4/2}$

であり、式中、R^1、R^2、R^3、R^8、R^9及びR^{12}は独立に炭素原子数１～６０の一価炭化水素基であり、R^4、R^5及びR^{10}は独立に炭素原子数１～６０の一価炭化水素基又は水素であり、R^6、R^7及びR^{11}は独立に炭素原子数１～６０の一価炭化水素基又はR^Eであり、各R^Eは独立に炭素原子数１～６０の１以上のオキシラン部分を有する一価炭化水素基であり、化学量論的添字ａ、ｂ、ｃ、ｄ、ｅ、ｆ、ｇ、ｈ、ｉ及びｊはゼロ又は正の数であるが、$a+b+c>1$、$b+e+h>1$、$c+f+i>1$、$b+e+h>c+f+i$であり、$d+e+f+g+h+i+j=0$のときは$a+b+c=2$であることを条件とする。

【０００６】

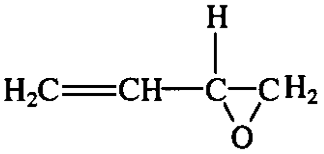
本発明の組成物の製造方法の一つは、ヒドロシリル化条件下で、次式の分子を、１以上のオキシラン部分を有するオレフィン性不飽和分子と、オキシランのモル量がシリルヒドリドのモル量よりも少ない化学量論条件で反応させることである。

$M_aM^H_{b'}D_dD^H_{e'}T_gT^H_{h'}Q_j$

ただし、定義及び関係は後で定義する通りである（上記定義とも一致する）。本明細書中で、「１以上のオキシラン部分を有するオレフィン性不飽和分子」とは、１以上の内部、側鎖又は末端炭素炭素二重結合を有する分子で、同時に１以上の内部、側鎖又は末端三員含酸素複素環を有する分子を意味する（本明細書では、化学的に、「三員含酸素複素環」はオキシラン又はエポキシド構造と同義に用いる）。かかる定義で例示される最も簡単な化学構造は次のものである。

【０００７】

【化１】

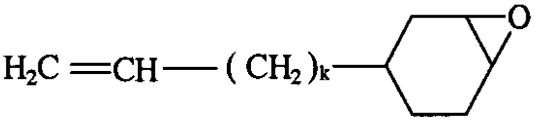


【０００８】

ただし、次式で例示される脂環式構造も包含される。

【０００９】

【化２】



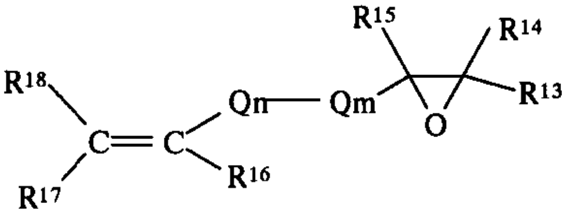
【００１０】

式中、ｋは０又は正の整数であり、さらに好ましくは略０～約１０の範囲の正の整数である。なお、ここで例示した構造はいずれもオレフィン性部分及びオキシラン（エポキシド

）部分が共に末端である。さらに一般的な化学構造は次のものである。

【００１１】

【化３】



【００１２】

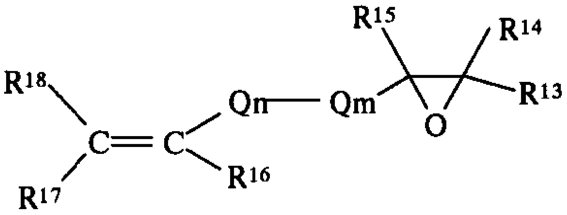
式中、R^{13}、R^{14}、R^{15}、R^{16}、R^{17}及びR^{18}は各々独立に水素及び炭素原子数１～６０の一価炭化水素基からなる群から選択され、Q_mは炭素原子数１～６０の二価又は三価炭化水素基であり、Q_nは炭素原子数１～６０の二価炭化水素基であり、ｍ及びｎは独立に０又は１であるが、Q_mが三価のときはR^{13}又はR^{14}の一方が存在せず、またR^{16}とR^{18}は互いにシスでもトランスでもよい。

【００１３】

したがって、本発明の反応生成物を製造するための可能な合成経路の一つは、ヒドロシリル化条件下で、次式の化合物と$M_aM^H{}_{b'}D_dD^H{}_{e'}T_gT^H{}_{h'}Q_j+\alpha$を反応させて$M_aM^H{}_bM^E{}_cD_dD^H{}_eD^E{}_fT_gT^H{}_hT^E{}_iQ_j$とするものであり、

【００１４】

【化４】

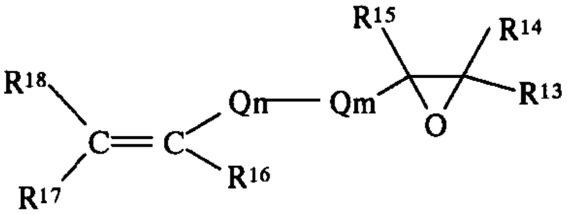


【００１５】

式中化学量論係数のαは$b'+e'+h'$の和より小さい。なお、化学量論係数ｂ、ｅ及びｈは、反応体及び生成物双方におけるヒドリド含有化学種M^H、D^H及びT^Hの量を定めており、互いにそうした関係を有するが、ヒドリド含有官能基の若干は１以上のオキシラン部分を有するオレフィン性不飽和分子と反応するので必然的に$b'+e'+h'>b+e+h$及び$b+c+e+f+h+i=b'+e'+h'$という関係が得られる。なお、オレフィン性不飽和オキシラン含有分子のアセチレン類似体は、反応で同様の生成物を形成する類似化学種を生成する。そこで、本明細書で１以上のオキシラン部分を有するオレフィン性不飽和分子というときは１以上のオキシラン部分を有するアセチレン性不飽和分子も包含する。「１以上のオキシラン部分を有するアセチレン性不飽和分子」とは、１以上の内部、側鎖又は末端炭素炭素三重結合を有する分子で、同時に１以上の内部、側鎖又は末端三員含酸素複素環を有する分子を意味する（本明細書では、化学的には「三員含酸素複素環」はオキシラン構造又はエポキシド構造と同義に用いる）。エポキシド化合物がオレフィン性エポキシドの場合、具体例は次のものである。

【００１６】

【化５】

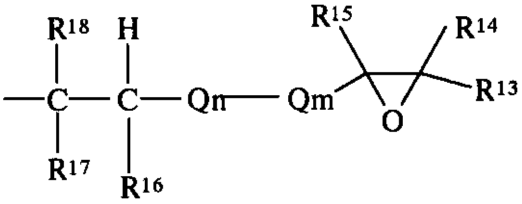


【００１７】

ここで、置換基としてのＲ^{E}は次式のものとなる。

【００１８】

【化６】

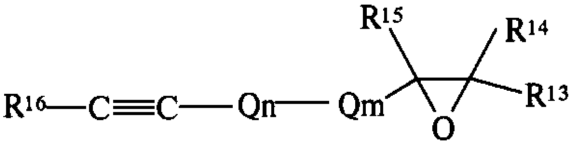


【００１９】

式中、定義はすべて前記定義と同じである。エポキシドがアセチレン性エポキシドの場合、具体例は次のものである。

【００２０】

【化７】

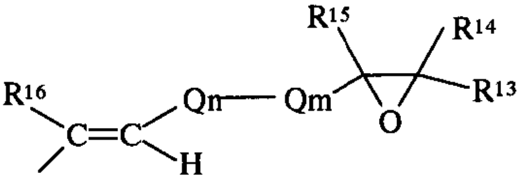


【００２１】

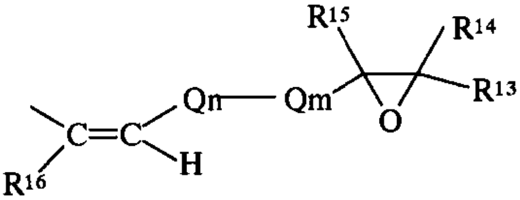
ここで、置換基としてのＲ^{E}は次式のいずれかとなる。

【００２２】

【化８】



又は



【００２３】

式中、定義はすべて前記定義と同じである。

【００２４】

シリルヒドリド含有前駆体分子$M_{a}M^{H}_{b}{}'D_{d}D^{H}_{e}{}'T_{g}T^{H}_{h}{}'Q_{j}$は当技術分野で公知の様々な技術で製造できる。エポキシ置換シロキサンは、ヒドロシリル化反応を用いる通常の方法でビニル又はアリル置換エポキシドをＳｉＨ含有シロキサンに付加させて製造する。ＳｉＨ含有シロキサンは当技術分野で周知であり、線状、枝分れ又は環状構造とすることができる。有用なビニル又はアリル置換エポキシドの例としては、４－ビニルシクロヘキセンオキシド、アリルグリシジルエーテル、リモネンオキシド、１，２－エポキシ－５－ヘキセン、１，２－エポキシ－７－オクテン、ノルボルナジエンモノエポキシド及び１，２－エポキシ－９－デセンがある。エポキシシロキサンの製造に適した貴金属触媒も当技術分野で周知であり、ロジウム、ルテニウム、パラジウム、オスミウム、イリジウム及び／又は白金の錯体からなる。

【００２５】

こうしたＳｉＨオレフィン付加反応（ヒドロシリル化）には多種多様な白金触媒が知られており、かかる白金触媒を本発明の反応に使用し得る。光学的透明性が必要とされる場合に好ましい白金触媒は反応混合物に可溶性の白金化合物触媒である。白金化合物は、米国特許第３１５９６０１号（援用によって本明細書に取り込まれる）に記載されている式（$\mathrm{PtCl_2}$オレフィン）及びＨ（$\mathrm{PtCl_3}$オレフィン）を有するものから選択できる。本発明の組成物に使用し得る別の白金含有物質は米国特許第３１５９６６２号（援用によって本明細書に取り込まれる）に記載されている塩化白金のシクロプロパン錯体である。さらに白金含有物質は、米国特許第３２２０９７２号（援用によって本明細書に取り込まれる）に記載されているように、クロロ白金酸と、白金１グラム当たり２モル以下のアルコール、エーテル、アルデヒド及びこれらの混合物からなる群から選択されるものから形成される錯体であってもよい。使用に好ましい触媒はＫａｒｓｔｅｄｔの米国特許第３７１５３３４号、同第３７７５４５２号及び同第３８１４７３０号に記載されている。この分野のさらに詳しい技術的背景については、Ｆ．Ｇ．Ａ．Ｓｔｏｎｅ及びＲ．Ｗｅｓｔ編、Ａｄｖａｎｃｅｓ ｉｎ Ｏｒｇａｎｏｍｅｔａｌｌｉｃ Ｃｈｅｍｉｓｔｒｙ第１７巻、４０７～４４７頁（１９７９年、Ａｃａｄｅｍｉｃ Ｐｒｅｓｓ（米国ニューヨーク）発行）のＪ．Ｌ．Ｓｐｉｅｒ著“Ｈｏｍｏｇｅｎｅｏｕｓ Ｃａｔａｌｙｓｉｓ ｏｆ Ｈｙｄｒｏｓｉｌａｔｉｏｎ ｂｙ Ｔｒａｎｓｉｔｉｏｎ Ｍｅｔａｌｓ”を参照されたい。白金触媒の有効量は当業者が容易に決定し得る。一般に、有効量は全オルガノポリシロキサン組成物百万部当たり約０．１～５０部の範囲である。

【００２６】

$M_aM^H_bM^E_cD_dD^H_eD^E_fT_gT^H_hT^E_iQ_j$の反応生成物は、ポリエーテルシロキサンコポリマー網目構造（又はシロキサンポリエーテルコポリマー網目構造）と考えられるポリマー網目構造を生成する。本明細書で用いる「網目構造」という用語は、相互に結合したポリエーテルシロキサンコポリマー鎖からなる三次元に延びる構造を意味する。この網目構造の隙間内に流体が含まれるのが好ましい。本明細書で網目構造について用いる「隙間」という用語は、網目構造内の空間、すなわち網目構造のポリエーテルシロキサンコポリマー鎖間の空間を意味する。本明細書でポリエーテルシロキサンコポリマー網目構造について用いるポリエーテルという用語は、２以上のエポキシド部分が反応してシロキサン鎖又は部分間の架橋を形成する１以上のエーテル結合を形成した反応生成物を包含する。

【００２７】

好ましい一実施形態では、ポリエーテルシロキサンコポリマー網目構造は、本発明のシリコーン組成物の流体成分に不溶であるがその流体により膨潤することができる架橋網目構造である。この架橋網目構造内に存在する架橋の量は、その流体中で網目構造が示す膨潤の程度に関して特徴付けることができる。別の好ましい実施形態では、網目構造の架橋構造は、例えばデカメチルシクロペンタシロキサンのような低分子量シリコーン流体により、その網目構造を、その当初の体積から、その１．０１～５０００倍、好ましくは２～１０００倍、さらに好ましくは５～５００倍の膨潤体積に膨潤させることができるものである。網目構造の当初の体積は、例えば、本発明のシリコーン組成物から流体成分をすべて抽出するか又は蒸発させてその元々の体積、すなわち流体の存在しないポリエーテルシロキサンコポリマー網目構造の体積にすることによって決定することができる。

【００２８】

本明細書中で用いる「炭化水素基」という用語には、非環式炭化水素基、脂環式炭化水素基及び芳香族炭化水素基が包含される。

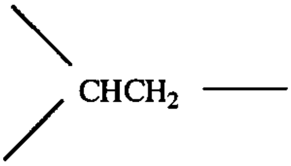
【００２９】

本明細書中で炭化水素基について用いる「一価」という用語はその基が１基当たり１つの共有結合を形成できることを意味し、「二価」という用語はその基が１基当たり２つの共有結合を形成できることを意味し、「三価」という用語はその基が１基当たり３つの共有結合を形成できることを意味する。一般に、一価基は飽和炭化水素化合物から概念上水素原子１個を除去して得られる当該化合物の誘導体として表すことができ、二価基は飽和炭化水素化合物から概念上水素原子２個を除去して得られる当該化合物の誘導体として表す

ことができ、三価基は飽和炭化水素化合物から概念上水素原子３個を除去して得られる当該化合物の誘導体として表すことができる。例えば、エチル基－CH_2CH_3基は一価基であり、ジメチレン基、即ち－（CH_2）$_2$－基は二価基であり、エタントリイル基、即ち次式の基は三価基であり、これらはいずれも飽和炭化水素であるエタンから１以上の水素原子を概念的に除去することで誘導されたものとして表すことができる。

【００３０】

【化９】



【００３１】

本明細書中で用いる「非環式炭化水素基」という用語は、直鎖又は枝分れ炭化水素基で、好ましくは１基当たりの炭素原子数が１～６０のものを意味するが、これは飽和でも不飽和でもよく、任意には、１以上の原子又はカルボキシル、シアノ、ヒドロキシ、ハロ及びオキシなどの官能基で置換もしくは中断されていてもよい。これらの官能基がエポキシド又はオキシラン部分のカチオン性硬化メカニズムを妨害しない限り、好適な一価非環式炭化水素基として、アルキル、アルケニル、アルキニル、ヒドロキシアルキル、シアノアルキル、カルボキシアルキル、アルキルオキシ、オキサアルキル、アルキルカルボニルオキサアルキレン、カルボキサミド及びハロアルキルを挙げることができ、具体的にはメチル、エチル、ｓｅｃ－ブチル、ｔｅｒｔ－ブチル、オクチル、デシル、ドデシル、セチル、ステアリル、エテニル、プロペニル、ブチニル、ヒドロキシプロピル、シアノエチル、ブトキシ、２，５，８－トリオキサデカニル、カルボキシメチル、クロロメチル及び３，３，３－トリフルオロプロピルなどがある。好適な二価非環式炭化水素基には、例えば、線状又は枝分れアルキレン基、例えばメチレン、ジメチレン、トリメチレン、デカメチレン、エチルエチレン、２－メチルトリメチレン、２，２－ジメチルトリメチレンなど、並びに線状又は枝分れオキサアルキレン基、例えばメチレンオキシプロピレンなどがある。好適な三価非環式炭化水素基には、例えば、アルカントリイル基、例えば１，１，２－エタントリイル、１，２，４－ブタントリイル、１，２，８－オクタントリイル、１，２，４－シクロヘキサントリイルなど、並びにオキサアルカントリイル基、例えば１，２，６－トリイル－４－オキサヘキサンなどがある。

【００３２】

本明細書中で用いる「アルキル」という用語は、飽和線状又は枝分れ一価炭化水素基を意味する。好ましい実施形態では、一価アルキル基は、例えばメチル、エチル、プロピル、イソプロピル、ｎ－ブチル、イソブチル、ｓｅｃ－ブチル、ｔｅｒｔ－ブチル、ペンチル、ヘキシル、ヘプチル、デシル、ドデシルなどの１基当たりの炭素原子数が１～６０の線状又は枝分れアルキル基から選択される。

【００３３】

本明細書中で用いる「アルケニル」という用語は、線状又は枝分れ一価末端不飽和炭化水素基を意味し、好ましくは１基当たりの炭素原子数が２～１０のもので、例えばエテニル、２－プロペニル、３－ブテニル、５－ヘキセニル、７－オクテニル及びエテニルフェニルなどがある。

【００３４】

本明細書中で用いる「脂環式炭化水素基」という用語は、１基当たり１以上の飽和炭化水素環を含む基で、好ましくは環１個当たりの炭素原子数が４～１２のものを意味するが、任意には１以上の環が１以上のアルキル基（各々好ましくは１基当たりの炭素原子数が２～６のもの）、ハロゲン基、その他の官能基で置換されていてもよく、２以上の環を有する一価脂環式炭化水素基の場合には縮合環であってもよい。好適な一価脂環式炭化水素基には、例えばシクロヘキシル、シクロオクチルがある。好適な二価炭化水素基には、飽和

又は不飽和二価単環式炭化水素基、例えば１，４－シクロヘキシレンがある。好適な三価脂環式炭化水素基には、例えば、１－ジメチレン－２，４－シクロヘキシレン、１－メチルエチレン－３－メチル－３，４－シクロヘキシレンのようなシクロアルカントリイル基がある。

【００３５】
本明細書中で用いる「芳香族炭化水素基」という用語は、１基当たり１以上の芳香族環を含む炭化水素基を意味するが、任意には芳香族環が１以上のアルキル基（各々好ましくは１基当たりの炭素原子数が２～６のもの）、ハロゲン基、その他の官能基で置換されていてもよく、２以上の環を有する一価芳香族炭化水素基の場合には縮合環であってもよい。好適な一価芳香族炭化水素基には、例えばフェニル、トリル、２，４，６－トリメチルフェニル、１，２－イソプロピルメチルフェニル、１－ペンタレニル、ナフチル、アントリル、オイゲノール及びアリルフェノール並びに例えば２－フェニルエチルのようなアラルキル基がある。好適な二価芳香族炭化水素基には、例えば１，２－フェニレン、１，４－フェニレン、４－メチル－１，２－フェニレン、フェニルメチレンなどの二価単環式アレーンがある。好適な三価芳香族炭化水素基には、例えば１－トリメチレン－３，５－フェニレンなどの三価単環式アレーンがある。

【００３６】
好ましい実施形態では、エポキシ官能性オルガノシロキサン化合物を、カチオン性重合条件下で、好ましくは流体（さらに好ましくは揮発性シロキサン流体）の存在下で、重合させることによってエポキシ官能性オルガノシロキサン化合物を反応させる。一実施形態では、エポキシ官能性オルガノシロキサン化合物を流体の存在下で重合させて本発明のシリコーン組成物を直接形成する。別の実施形態では、エポキシ官能性オルガノシロキサン化合物を第一の流体又は流体混合物の存在下で重合させてポリエーテルシロキサンコポリマー網目構造を形成した後、生成した網目構造を次に第二の流体又は流体混合物で膨潤させて本発明のシリコーン組成物を形成する。第二の流体又は流体混合物は第一の流体混合物と同一でも異なるものでもよい。第一の溶媒は、任意には、第二の流体を添加する前に、例えば蒸発によって、重合網目構造から除去してもよい。別法では、流体を存在させずにエポキシ官能性オルガノシロキサン化合物を重合させてポリエーテルシロキサンコポリマー網目構造を形成し、次に網目構造を流体又は流体混合物で膨潤させて本発明のシリコーン組成物を形成する。別の実施形態では、エポキシ官能性オルガノシロキサンの重合は、重合後に残留ヒドリドが残るよう十分な量の過剰のヒドリドシロキサン官能基と共に実施し、残留ヒドリドは後でヒドロシリル化に適した条件下で１以上のアルケニル官能性化合物と反応させる。これは、アルケニル官能性化合物がカチオン性硬化の抑制剤として機能し得る場合に特に有利である。かかるアルケニル化合物は、塩基のようなカチオン性硬化メカニズムの抑制剤として機能し得る官能基を有するものである。別の実施形態では、重合速度を速くするために、濃縮ヒドリドシロキサン化合物又はヒドリドシラン化合物を少量加える。

【００３７】
カチオン性重合条件は、エポキシ基を重合させることができる酸触媒を添加することにより生成することができ、例えば、酸と、例えば三塩化アルミニウムや塩化第二鉄のようなルイス酸として機能するある種の金属塩とから生成したオニウム塩を添加したり、又はランタニドトリフレートを添加したりすることができる。国際公開第００／０８０８７号参照。エポキシドの酸触媒重合は有機ポリマーを形成する方法として周知であり、例えば紙用剥離コーティング（例えば米国特許第４２７９７１７号参照）や有機材料と併用して塗料や改質プラスチック組成物の製造（例えば米国特許第５３５４７９６号及び同第５６６３７５２号参照）など様々な用途に用いられるシロキサンポリアルキレンオキシドブロックコポリマーを形成するためエポキシ官能性シロキサン化合物に応用されている。一言忠告しておくべき事項として、D_3、D_4又はD_5など環状シロキサンの存在下でカチオン性重合を行う場合、使用する酸触媒の強度は、エポキシド部分のカチオン性重合は起こるが認めうるほどの環状シロキサンの重合が起こらないようにしなければならないことである

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【００３８】

好ましい実施形態では、白金とＳｉＨ含有化合物との相互作用によって生じたカチオン性硬化条件下でエポキシ官能性オルガノシロキサン化合物を重合させる。このエポキシド重合反応経路は米国特許第５１２８４３１号並びにＪ．Ｖ．Ｃｒｉｖｅｌｌｏ及びＮ．Ｆａｎ，Ｊ．Ｐｏｌｙｍｅｒ Ｓｃｉ．，Ｐａｒｔ Ａ：Ｐｏｌｙｍｅｒ Ｃｈｅｍｉｓｔｒｙ，ｐｐ．１８５３－１８６３（１９９７）に記載されている。この実施形態では、反応キネティクスは微量の分子状酸素の存在に依存するようである。

【００３９】

本発明のポリエーテルシロキサンコポリマー網目構造組成物は、架橋のためある程度の立体障害をもった架橋構造を生じる。こうした立体障害は、長時間の反応によっても反応が最後まで進行するのを妨げる傾向があり、そのためある程度の量の残留官能基が残留しかねない。こうした残留官能基は、ポリエーテルシロキサンコポリマー網目構造ほどは立体的制約のない官能化分子との反応でポリエーテルシロキサンコポリマー網目構造中に他の官能基を導入することが可能になるが、さもなければ残留官能基は化学的に不活性化されていなければならない。残留官能基が化学的に不活性化されるのが望ましい一つの理由は次の通りである。即ち、これらの材料を加工処理する際、ポリエーテルシロキサンコポリマー網目構造は低分子量シロキサン化合物（又は低分子量シリコーン流体）、通常は後に定義するＤ$_3$、Ｄ$_4$、Ｄ$_5$、Ｄ$_6$又はＭ′Ｄ′$_q$Ｔ′$_s$Ｍ′により膨潤されているので、高剪断条件下での加工処理は、網目構造を破壊して立体障害のレベルが下がり、化学的に露出した残留官能基のために架橋反応がさらに起こるようになりかねないからである。ヒドロシリル化によって付加重合が起こる場合、付加重合シリコーン中で後硬化架橋が起こることが知られている。これらの材料は最初シリルヒドリドとオレフィン性又はアセチレン性オキシラン又はエポキシド化合物とのヒドロシリル化によって製造される。したがって、貴金属ヒドロシリル化触媒が反応混合物中又はポリエーテルシロキサンコポリマー網目構造の隙間内に存在している。この触媒を用いて、反応生成物中に組み込まれたオキシラン又はエポキシド部分をさらに重合させて本発明のポリエーテルシロキサンコポリマー網目構造を生成することができる。設計により、すなわち、化学量論以下の量の使用により、又は反応の完了を妨害する立体障害により、残った残留官能基は本発明の教示に従ってさらに反応させたり、又は中和したりもしくは抑制したりすることができる。米国特許第５９７７２８０号及び同第５９２９１６４号（いずれも援用によって本明細書に取り込まれる）には、強力な貴金属錯体形成性リガンド、例えばホスフィン、アミン、及び有機スルフィドやチオールのような有機イオウ化合物での処理によるヒドロシリル化触媒の前記のような中和が教示されている。しかし、これらの強力な錯体形成性リガンドのあるものは貴金属ヒドロシリル化触媒を失活させるが毒性であり、したがってその使用はある種の用途、例えばパーソナルケア用途では避けなければならない。イオウを含有するアミノ酸エステルは強力な貴金属錯体形成性リガンドであり、メチオニンメチルエステル、メチオニンエチルエステル、システインメチルエステル、システインエチルエステル及びシステインジメチルエステルが前記のような貴金属失活に好ましく用いられて来ている。なお、容易に破壊されるジスルフィド結合を含有する天然のタンパク質、例えば卵黄なども使用する貴金属触媒を失活するのに使用できる。イオウを含有するアミノ酸アミド、ポリペプチドなどもまた同様に、貴金属ヒドロシリル化触媒を失活させるように機能し得る。

【００４０】

このポリマー合成法により広範囲の有機官能基をコポリマー構造中に組み込むことが可能である。すなわち、例えば有機エポキシド、エポキシシロキサン、末端不飽和の有機及びアルケニルシロキサン化合物のような他の有機官能基を含ませることによって、得られるコポリマーを改質することができる。

【００４１】

別の実施形態では、エポキシ官能性オルガノシロキサンの重合中に、選択された重合反応条件下でエポキシ官能性オルガノシロキサンと共重合可能な有機官能性化合物を反応混合

物に含ませることによって有機官能基を網目構造に導入する。

【００４２】

一実施形態では、エポキシ官能性オルガノシロキサンの重合を、重合条件下でエポキシ官能性ヒドリドシロキサンと共重合して混合ポリアルキレンオキシド単位を形成することができる１種以上の有機エポキシド化合物の存在下で実施する。この追加の有機エポキシド化合物は得られるコポリマーをさらに改質する別の置換基を含有していてもよい。好適な有機エポキシド化合物としては、例えば、エチレンオキシド、プロピレンオキシド、ブチレンオキシド、シクロヘキセンオキシド、グリシドール及び、例えばエポキシド化大豆油のようなエポキシド油がある。

【００４３】

別の実施形態では、エポキシ官能性オルガノシロキサンの重合を、重合条件下でエポキシ官能性ヒドリドシロキサンと共重合して生成物のコポリマーを改質することができる１種以上のヒドロキシ官能性化合物の存在下で実施する。好適なヒドロキシ官能性化合物としては、例えば、水、ヒドロキシ停止ポリエーテル、有機アルコール、例えば有機ジオール、カルビノール官能性シロキサン、及びヒドロキシ官能性オルガノポリシロキサンポリマー、例えばポリエーテルシロキサンコポリマーがある。

【００４４】

別の実施形態では、エポキシ官能性オルガノシロキサンの重合を、重合条件下でエポキシ官能性ヒドリドシロキサンと共重合して生成物のコポリマーを改質することができる１種以上のアルケニル官能性化合物の存在下で実施する。好適なアルケニル官能性化合物としては、例えばヘキサジエンのようなアルケニル官能性有機化合物及び、例えばビニルポリジメチルシロキサンのようなアルケニル官能性シリコーン化合物がある。例えば、アルケニル官能性化合物は、前記のように白金とヒドリド置換シロキサンを用いて、エポキシド基を反応させるカチオン性反応条件を生じさせる実施形態でヒドロシリル化によって便利に添加することができる。

【００４５】

シリコーン組成物は、低～高剪断下でさらに加工処理して組成物の粘度と知覚上の感触を調節することができる。これは、例えば、組成物に中程度～高度の剪断力をかけることによって行うことができる。高剪断は、例えばＳｏｎｏｌａｔｏｒ装置、Ｇａｕｌｉｎ Ｈｏｍｏｇｅｎｉｚｅｒ又はＭｉｃｒｏ Ｆｌｕｉｄｉｚｅｒ装置を用いてかけることができる。任意には、剪断の前にシリコーン組成物に１種以上の流体を加えてもよい。

【００４６】

好ましい実施形態では本発明のシリコーン組成物は固体、典型的にはクリームのコンシステンシーを有する固体であり、この場合コポリマー網目構造は流体をゲル化してその流体に固体の特性を可逆的に付与する手段として働く。静止状態では、シリコーン組成物は固体のゲル材料の特性を示す。本発明のシリコーン組成物は高い安定性とシネレシスに対する抵抗性を示す。すなわち、本発明の組成物は流体が組成物から流れ出る傾向をほとんど又はまったく示さず、このシリコーン組成物を成分として含むパーソナルケア組成物に高い安定性とシネレシス抵抗性を付与する。この高い安定性とシネレシス抵抗性は、かかるシリコーン組成物及びパーソナルケア組成物の長期のエージングで存続する。しかし、例えば指の間で組成物を擦ることなどによりシリコーン組成物に剪断力を加えることによって流体を網目構造から放出させてシリコーン材料の流体成分の向上した知覚感触特性をもたらすことができる。

【００４７】

本発明の組成物の流体成分として使用するのに適した流体は、室温又はその付近、例えば約２０～約５０℃で、そして約１気圧の圧力で液体状態にある化合物又はかかる化合物２種以上の混合物であり、例えば、シリコーン流体、炭化水素流体、エステル、アルコール、脂肪アルコール、グリコール及び有機油がある。好ましい実施形態では、本発明の組成物の流体成分は、２５℃で約１０００ｃＳｔ未満、好ましくは約５００ｃＳｔ未満、さらに好ましくは約２５０ｃＳｔ未満、最も好ましくは１００ｃＳｔ未満の粘度を示す。

【００４８】
好ましい実施形態では本発明の流体成分がエモリエント（皮膚軟化剤）化合物からなる。好適なエモリエント化合物としては、エモリエント特性を示すあらゆる流体、すなわち、皮膚に塗布したときに皮膚の表面上又は皮膚の角質層内に止まって滑剤として機能し、フレーキングを低下させ、かつ皮膚の外観を改善する傾向があるあらゆる流体が包含される。エモリエント化合物は一般に知られており、例えば、炭化水素（例えばイソドデカン、イソヘキサデカン及び水素化ポリイソブテンなど）、有機ワックス（例えばホホバなど）、シリコーン流体（例えばシクロペンタシロキサン、ジメチコーン及びビス－フェニルプロピルジメチコーンなど）、エステル（例えばネオペンタン酸オクチルドデシル及びオレイン酸オレイルなど）、並びに脂肪酸及びアルコール（例えばオレイルアルコール及びイソミリスチルアルコールなど）がある。

【００４９】
極めて好ましい実施形態では、本発明の流体成分はシリコーン流体からなり、さらに好ましくはエモリエント特性を示すシリコーン流体、好ましくは低分子量シリコーン流体又は低分子量シロキサン化合物からなる。好適なシリコーン流体としては、例えば、式D_rの環状シリコーン［式中、Ｄ、R^8及びR^9は既に定義した通りであり、好ましくはR^8及びR^9は炭素原子１～６個の一価炭化水素基からなる群から選択され、さらに好ましくはメチルであり、ｒは３≦ｒ≦１２の整数である］、例えば、ヘキサメチルシクロトリシロキサン（「D_3」）、オクタメチルシクロテトラシロキサン（「D_4」）、デカメチルシクロペンタシロキサン（「D_5」）及びドデカメチルシクロヘキサシロキサン（「D_6」）、並びに、次式を有する線状又は枝分れオルガノポリシロキサンがある。

$M'D'_qT'_sM'$

式中、

M'は$R^{19}{}_3SiO_{1/2}$であり、

D'は$R^{20}{}_2SiO_{2/2}$であり、

T'は$R^{21}SiO_{3/2}$であり、

R^{19}、R^{20}及びR^{21}は各々独立に１～６０個の炭素原子を含有するアルキル、アリール又はアラルキルであり、

ｑとｓは各々独立に０～３００、好ましくは０～１００、さらに好ましくは０～５０、最も好ましくは０～２０の整数である。

【００５０】
好ましい実施形態では、本発明のシリコーン組成物は、このシリコーン組成物１００重量部（「ｐｂｗ」）につき、ポリエーテルシロキサンコポリマー網目構造を０．１～９９ｐｂｗ、さらに好ましくは０．５～３０ｐｂｗ、さらに一層好ましくは１～１５ｐｂｗ、そして流体を１～９９．９ｐｂｗ、さらに好ましくは７０～９９．５ｐｂｗ、さらに一層好ましくは８５～９９ｐｂｗ含んでいる。

【００５１】
本発明のポリエーテルシロキサンコポリマー網目構造組成物は製造したままで、又はエマルジョン中のシリコーン成分として使用することができる。一般に知られているように、エマルジョンは少なくとも２つの不混和性相からなり、一方は連続で他方は不連続である。またエマルジョンは様々な粘度の液体又は固体であってもよい。さらに、エマルジョンの粒度によってはマイクロエマルジョンとなることもあり、十分に小さいマイクロエマルジョンは透明であり得る。また、エマルジョンのエマルジョンを製造することも可能であり、これらは一般に多相エマルジョンとして知られている。これらのエマルジョンは次のものであり得る。

１）不連続相が水からなり、連続相が本発明のポリエーテルシロキサンコポリマー網目構造からなる水性エマルジョン、

２）連続相が本発明のポリエーテルシロキサンコポリマー網目構造からなり、不連続相が水からなる水性エマルジョン、

３）不連続相が非水性ヒドロキシル溶媒からなり、連続相が本発明のポリエーテルシロキ

サンコポリマー網目構造からなる非水性エマルジョン、
４）連続相が非水性ヒドロキシル溶媒からなり、不連続相が本発明のポリエーテルシロキサンコポリマー網目構造からなる非水性エマルジョン。

【００５２】

シリコーン相を含む非水性エマルジョンは米国特許第６０６０５４６号及び１９９８年３月３日に出願された同時係属中の米国特許出願第０９／０３３７８８号（その開示内容は特に引用したことにより本明細書に含まれているものとする）に記載されている。

【００５３】

本明細書中で用いる「非水性ヒドロキシル有機化合物」という用語は、室温、例えば約２５℃、そして約１気圧の圧力で液体であるアルコール、グリコール、多価アルコール及びポリマー性グリコール並びにこれらの混合物で例示されるヒドロキシルを含有する有機化合物を意味する。非水性有機ヒドロキシル溶媒は、室温、例えば約２５℃、そして約１気圧の圧力で液体であるアルコール、グリコール、多価アルコール及びポリマー性グリコール並びにこれらの混合物を含むヒドロキシルを含有する有機化合物からなる群から選択される。好ましくは、非水性ヒドロキシル有機溶媒は、エチレングリコール、エタノール、プロピルアルコール、イソプロピルアルコール、プロピレングリコール、ジプロピレングリコール、トリプロピレングリコール、ブチレングリコール、イソブチレングリコール、メチルプロパンジオール、グリセリン、ソルビトール、ポリエチレングリコール、ポリプロピレングリコールモノアルキルエーテル、ポリオキシアルキレンコポリマー及びこれらの混合物からなる群から選択される。

【００５４】

シリコーンのみの相、シリコーン相を含む無水混合物、シリコーン相を含む水和混合物、油中水型エマルジョン、水中油型エマルジョン、又は２種の非水性エマルジョンのいずれかもしくはその変形としてのいずれであっても一旦所望の形態が達成されたら、得られた材料は通常良好な感触特性をもち、揮発性シロキサンを高度に吸収した高粘度のクリームであり、ヘアケア、スキンケア、制汗剤、日焼け止め、化粧品、カラーコスメチック、虫よけ、ビタミン及びホルモン担体、香料担体などの調合製品中に配合することができる。

【００５５】

本発明のポリエーテルシロキサンコポリマー網目構造及びそれから得られる本発明のシリコーン組成物を使用できるパーソナルケア用途としては、デオドラント、制汗剤、制汗／防臭剤、シェービング製品、スキンローション、モイスチャライザー、トナー、浴用製品、クレンジング製品、ヘアケア製品、例えばシャンプー、コンディショナー、ムース、スタイリングジェル、ヘアスプレー、染毛剤、ヘアカラー製品、ヘアブリーチ、ウェービング製品、ヘアストレートナー、マニキュア製品、例えばネイルポリッシュ、ネイルポリッシュリムーバー、ネイルクリーム及びローション、キューティクルソフトナー、保護クリーム、例えば日焼け止め、虫よけ及び老化防止製品、カラーコスメチック、例えば口紅、ファンデーション、白粉、アイライナー、アイシャドー、頬紅、メーキャップ、マスカラ、その他従来からシリコーン成分が添加されているパーソナルケア製品、並びに皮膚に塗布する薬用組成物の局所投与のためのドラッグデリバリーシステムがあるが、限定されることはない。

【００５６】

好ましい実施形態では、本発明のパーソナルケア組成物はさらに１種以上のパーソナルケア成分を含んでいる。好適なパーソナルケア成分としては、例えば、エモリエント、モイスチャライザー、保湿剤、例えばオキシ塩化ビスマスや二酸化チタン被覆雲母のような真珠光沢顔料を始めとする顔料、着色剤、香料、殺生物剤、防腐剤、酸化防止剤、抗菌剤、殺菌剤、制汗剤、エクスフォリアント、ホルモン、酵素、医用化合物、ビタミン、塩、電解質、アルコール、ポリオール、紫外線吸収剤、植物エキス、界面活性剤、シリコーン油、有機油、ワックス、塗膜形成剤、例えばヒュームドシリカや水和シリカのような増粘剤、粒状充填材、例えばタルク、カオリン、澱粉、化工澱粉、雲母、ナイロン、粘土、例えばベントナイト及び有機変性粘土がある。

【００５７】
好適なパーソナルケア組成物は、例えば混合するといったような当技術分野で公知の方法で、上記成分の１種以上を本発明のポリエーテルシロキサンコポリマー網目構造、好ましくはシリコーン組成物の形態のものと一緒にすることによって製造される。好適なパーソナルケア組成物は単一の相の形態であっても、或いはシリコーン相が不連続相か連続相のいずれかである水中油型、油中水型及び無水のエマルジョン並びに例えば油中水中油型及び水中油中水型のエマルジョンのような多相エマルジョンを含めてエマルジョンの形態であってもよい。

【００５８】
有用な一実施形態では、制汗組成物が、本発明のポリエーテルシロキサンコポリマー網目構造と１種以上の活性な制汗剤とを含んでいる。好適な制汗剤としては、例えば、ヒト用に店頭販売される制汗性医薬品に関する米国食品医薬品局の１９９３年１０月１０日付モノグラフに掲げられているカテゴリーＩの活性制汗性成分があり、例えば、ハロゲン化アルミニウム、ヒドロキシハロゲン化アルミニウム、例えばアルミニウムクロロハイドレート、及びこれらとオキシハロゲン化ジルコニル及びヒドロキシハロゲン化ジルコニルとの錯体又は混合物、例えばアルミニウム－ジルコニウムクロロハイドレート、アルミニウムジルコニウムグリシン錯体、例えばアルミニウムジルコニウムテトラクロロハイドレックスｇｌｙがある。

【００５９】
別の有用な実施形態では、スキンケア組成物が、本発明のポリエーテルシロキサンコポリマー網目構造、好ましくはシリコーン組成物の形態のものと、例えばシリコーン油や有機油のようなビヒクルとを含んでいる。任意には、このスキンケア組成物はさらに、例えばトリグリセリドエステル、ワックスエステル、脂肪酸のアルキルもしくはアルケニルエステル又は多価アルコールエステルのようなエモリエント、及び従来からスキンケア組成物に用いられている１種以上の公知の成分、例えば、顔料、ビタミン、例えばビタミンＡ、ビタミンＣ及びビタミンＥ、日焼け止めもしくはサンスクリーン化合物、例えば二酸化チタン、酸化亜鉛、オキシベンゾン、オクチルメトキシシンナメート、ブチルメトキシジベンゾイルメタン、ｐ－アミノ安息香酸及びオクチルジメチルｐ－アミノ安息香酸を含んでいてもよい。

【００６０】
別の有用な実施形態では、例えば口紅、メーキャップ又はマスカラ組成物のようなカラーコスメチック組成物が、本発明のポリエーテルシロキサンコポリマー網目構造、好ましくはシリコーン組成物の形態のものと、顔料、水溶性染料又は油溶性染料のような着色剤とを含んでいる。

【００６１】
別の有用な実施形態では、本発明の組成物を香料物質と組み合わせて使用する。これらの香料物質は、香料化合物、カプセル化された香料化合物、又は純粋な化合物であるかもしくはカプセル化された芳香放出性化合物であり得る。本発明の組成物と特に適合性のものは、米国特許第６０４６１５６号、同第６０５４５４７号、同第６０７５１１１号、同第６０７７９２３号、同第６０８３９０１号及び同第６１５３５７８号（いずれも引用により特に本明細書に含まれているものとする）に開示されているような芳香放出性含ケイ素化合物である。

【００６２】
本発明の組成物の用途はパーソナルケア組成物に限られることはなく、本発明の組成物で処理したワックス、光沢剤及び織物などのような他の製品も考えられる。

【実施例】

【００６３】
ポリエーテルシロキサンコポリマー網目構造組成物の製造実験

製造例１

概略組成が$M^{H}D_{300}D^{H}_{4}M^{H}$であるヒドリド流体４９４．５ｇを、ビニルシクロヘキセン

オキシド５．５ｇ、デカメチルシクロペンタシロキサン（Ｄ５）１５００ｇ、及び白金ジビニルテトラメチルジシロキサン触媒溶液０．１ｇと混合した。得られた混合物を８０℃に加熱した。２、３時間後、白金触媒溶液を追加して加えた。これを合計で４時間８０℃に加熱した。このようにして、固形分が約２６％のゲル状物ＥｘｐＭＪＯ－０７－３９１を得た。次に、５６７ｇのＥｘｐＭＪＯ－０７－３９１を１４３３ｇの追加のＤ５と混合した。その後、得られた混合物を４５００ｐｓｉでＧａｕｌｉｎホモジナイザーに二回通した。得られたＥｘｐＭＪＯ－０７－４０１は固形分が約７．３％、粘度が２４２００ｃｐｓであった。これを皮膚に擦りつけたところ極めてシルキーな感触であった。

【００６４】

製造例２

概略組成が$M^{H}D_{337}D^{H}_{11.8}M^{H}$であるヒドリド流体３００ｇを、ビニルシクロヘキセンオキシド３．９４ｇ、Ｃｈｅｖｒｏｎ製Ｇｕｌｆｔｅｎｅ Ｃ３０＋ Ａｌｐｈａ Ｏｌｅｆｉｎ Ｆｒａｃｔｉｏｎ（αオレフィン画分。以後、置換基の場合はＣ３０＋と定義する）３７ｇ、デカメチルシクロペンタシロキサン（Ｄ５）１０２２．８ｇ、及び白金ジビニルテトラメチルジシロキサン触媒溶液０．１ｇと混合した。得られた混合物を８時間８０℃に加熱してＥｘｐＭＪＯ－０７－４３３を得た。このものの固形分は約２５．５％であった。次に、５８７．５ｇのＥｘｐＭＪＯ－０７－４３３を１４１２．５ｇの追加のＤ５で膨潤させた後、４５００ｐｓｉでＧａｕｌｉｎホモジナイザーに通した。得られたＥｘｐＭＪＯ－０７－４３４は固形分が約７．４％、粘度が４５０００ｃｐｓであった。これを皮膚に擦りつけたところ同様にシルキーな感触であった。

【００６５】

製造例３

概略組成が$M^{H}_{1.73}D_{388}D^{H}_{6.9}M_{0.27}$であるヒドリド流体３００ｇを、ビニルシクロヘキセンオキシド３．００ｇ、Ｃｈｅｖｒｏｎ製Ｇｕｌｆｔｅｎｅ Ｃ３０＋ Ａｌｐｈａ Ｏｌｅｆｉｎ Ｆｒａｃｔｉｏｎ９ｇ、デカメチルシクロペンタシロキサン（Ｄ５）９３６ｇ、及び白金ジビニルテトラメチルジシロキサン触媒溶液０．１ｇと混合した。得られた混合物を８時間８０℃に加熱してＥｘｐＭＪＯ－０７－４２２を得た。このものの固形分は約２５．７％であった。次に、５９１．４ｇのＥｘｐＭＪＯ－０７－４２２を１４０８．６ｇの追加のＤ５で膨潤させた後、４５００ｐｓｉでＧａｕｌｉｎホモジナイザーに通した。得られたＥｘｐＭＪＯ－０７－４３７は固形分が約７．２６％、粘度が３９０００ｃｐｓであった。

【００６６】

製造例４

概略組成が$M^{H}_{1.73}D_{388}D^{H}_{6.9}M_{0.27}$であるヒドリド流体３００ｇを、ビニルシクロヘキセンオキシド３．００ｇ、Ｃ－１６／１８ Ａｌｐｈａ Ｏｌｅｆｉｎ Ｆｒａｃｔｉｏｎ３ｇ、デカメチルシクロペンタシロキサン（Ｄ５）９１８ｇ、及び白金ジビニルテトラメチルジシロキサン触媒溶液０．１ｇと混合した。得られた混合物を８時間８０℃に加熱してＥｘｐＭＪＯ－０７－４２４を得た。このものの固形分は約２５．７％であった。次に、５９１．４ｇのＥｘｐＭＪＯ－０７－４２４を１４０８．６ｇの追加のＤ５で膨潤させた後、４５００ｐｓｉでＧａｕｌｉｎホモジナイザーに通した。得られたＥｘｐＭＪＯ－０７－４３８は固形分が約７．５７％、粘度が３９５００ｃｐｓであった。

【００６７】

製造例５

概略組成が$M^{H}D_{337}D^{H}_{11.8}M^{H}$であるヒドリド流体３００ｇを、ビニルシクロヘキセンオキシド４．８９ｇ、Ｃｈｅｖｒｏｎ製Ｇｕｌｆｔｅｎｅ Ｃ３０＋ Ａｌｐｈａ Ｏｌｅｆｉｎ Ｆｒａｃｔｉｏｎ２６．４ｇ、デカメチルシクロペンタシロキサン（Ｄ５）７３３ｇ、及び白金ジビニルテトラメチルジシロキサン触媒溶液０．０８ｇと混合した。得られた混合物を６時間８０℃に加熱してＥｘｐＭＪＯ－０７－４６４を得た。このものの固形分は約３０．８４％であった。次に、５３３ｇのＥｘｐＭＪＯ－０７－４６４を９６７ｇの追加のＤ５で膨潤させた後、４５００ｐｓｉでＧａｕｌｉｎホモジナイザーに通した

。得られたＥｘｐＭＪＯ－０７－４６５は固形分が約１１％、粘度が２０００００ｃｐｓであった。

【００６８】

製造例６

概略組成が$MD_{100}D^{H}_{10.5}M$であるヒドリド流体３００ｇを、ビニルシクロヘキセンオキシド１３．５３ｇ、Ｃｈｅｖｒｏｎ製Ｇｕｌｆｔｅｎｅ Ｃ３０＋ Ａｌｐｈａ Ｏｌｅｆｉｎ Ｆｒａｃｔｉｏｎ３４．８４ｇ、デカメチルシクロペンタシロキサン（Ｄ５）６４７ｇ、及び白金ジビニルテトラメチルジシロキサン触媒溶液０．１０ｇと混合した。得られた混合物を６時間８０℃に加熱してＥｘｐＭＪＯ－０７－４７７を得た。このものの固形分は約３５．２５％であった。次に、５３３ｇのＥｘｐＭＪＯ－０７－４６４を９４７ｇの追加のＤ５で膨潤させた後、４５００ｐｓｉでＧａｕｌｉｎホモジナイザーに通した。得られたＥｘｐＭＪＯ－０７－４８２は固形分が約１２．６９％、粘度が１６５００ｃｐｓであった。

【００６９】

製造例７

概略組成が$M^{H}D_{200}D^{H}_{10.5}M^{H}$であるヒドリド流体３１６．４ｇを、ビニルシクロヘキセンオキシド７．５６ｇ、４－アリル－２－メトキシフェノール７．００ｇ、デカメチルシクロペンタシロキサン（Ｄ５）８４０ｇ、及び白金ジビニルテトラメチルジシロキサン触媒溶液０．０９ｇと混合した。得られた混合物を６時間８０℃に加熱してＥｘｐＭＪＯ－０８－５３７を得た。次に、４１８ｇのＥｘｐＭＪＯ－０８－５３７を５８２ｇの追加のＤ５で膨潤させた後、８０００ｐｓｉでＧａｕｌｉｎホモジナイザーに通した。得られたＥｘｐＭＪＯ－０８－５４０は固形分が約１２％、粘度が１９８０００ｃｐｓであった。

【００７０】

製造例８（ゲル化後のヒドロシリル化の例）

概略組成が$M^{H}D_{337}D^{H}_{11.8}M^{H}$であるヒドリド流体３００ｇを、ビニルシクロヘキセンオキシド３．９４ｇ、デカメチルシクロペンタシロキサン（Ｄ５）９０５．４ｇ、及び白金ジビニルテトラメチルジシロキサン触媒溶液０．１ｇと混合した。得られた混合物を良く掻き混ぜながら4時間８０℃に加熱した。ゲル化した反応混合物の少量の試料を採ってＦＴＩＲで分析したところ、明らかに残留ＳｉＨが残っていることが示された。次に、３０ｇのトリメチロールプロパンモノアリルエーテルのジイソステアリン酸エステル、１００ｇのＤ５及び1滴のＰｔ触媒の混合物を加えた。得られた混合物をさらに2時間８０℃に加熱した。この終了時に固形分が２５．１％のゲル（ゲルＥ）が得られた。ＦＴＩＲ分析により、ＳｉＨ伸縮（約２１４０ｃｍ$^{-1}$）の大きさが実質的に低下したことが示された。

【００７１】

製造例９（濃縮ヒドリドシロキサンの添加の例）

概略組成が$M^{H}_{1.73}D_{388}D^{H}_{6.9}M_{0.27}$であるヒドリド流体３００ｇを、ビニルシクロヘキセンオキシド３．００ｇ、４－アリル－２－メトキシフェノール４．００ｇ、Ｃｈｅｖｒｏｎ製Ｇｕｌｆｔｅｎｅ Ｃ３０＋ Ａｌｐｈａ Ｏｌｅｆｉｎ Ｆｒａｃｔｉｏｎ２０．８ｇ、デカメチルシクロペンタシロキサン（Ｄ５）９８４ｇ、及び白金ジビニルテトラメチルジシロキサン触媒溶液０．１ｇと混合した。得られた混合物を良く掻き混ぜながら１時間８０℃に加熱した。この時点で、トリメチルシリル停止メチル水素ポリシロキサン４ｇとデカメチルシクロペンタシロキサン５ｇの混合物を加えた。反応混合物は3分でゲル化した。反応を完了させるために加熱は5時間続けた。

【００７２】

製造例１０

概略組成が$M^{H}D_{200}D^{H}_{10.5}M^{H}$であるヒドリド流体３００ｇを、ビニルシクロヘキセンオキシド７．２２ｇ、Ｃｈｅｖｒｏｎ製Ｇｕｌｆｔｅｎｅ Ｃ３０＋ Ａｌｐｈａ Ｏｌｅｆｉｎ Ｆｒａｃｔｉｏｎ３４．１ｇ、デカメチルシクロペンタシロキサン（Ｄ５）７９６ｇ、及び白金ジビニルテトラメチルジシロキサン触媒溶液０．０８５ｇと混合した。得られた混合物を６時間８０℃に加熱してＥｘｐＭＪＯ－０７－４８１を得た。次に、５６

２ｇのＥｘｐＭＪＯ－０７－４８１を９３８ｇの追加のＤ５とＩｓｏｐａｒ Ｃ中のメチルジ（水添タロー）アミンの１０％溶液１．０ｇとの混合物で膨潤させた後、４５００ｐｓｉでＧａｕｌｉｎホモジナイザーに通した。得られたＥｘｐＭＪＯ－０７－４８４は固形分が約１１．５８％、粘度が８５０００ｃｐｓであった。

【００７３】

ポリエーテルシロキサンコポリマー網目構造組成物を用いた化粧品組成物の製造実験

化粧品実施例１

【００７４】

【表１】

組成	wt% A (対照)	wt% B (実施例 1)
ステアリルアルコール	15	15
水添ひまし油	5	5
イソドデカン	10	10
SF1202	45	35
タルク	1	1
Al Zr トリクロロハイドレックス Gly	24	24
ExpMJO-07-465	0	10

【００７５】

これらの制汗スティックを製造すべく、ステアリルアルコール、水添ひまし油、イソドデカン、ＳＦ１２０２及びＥｘｐＭＪＯ－０７－４６５を、これらのゲル化剤が融解するまで加熱した。Ａｌ・Ｚｒトリクロロハイドレックスｇｌｙを７０℃でバッチに加え、均一になるまで混合した。制汗剤を約６０℃で容器に注入した。この制汗剤の白さ、保液能、感触、及びスティックの硬さを評価した。この白さを決定するには、消費者の塗り方を模倣するために暗色のビニールスライド上に制汗剤を塗布し、ビニールテストスライドを１５分間風乾し、外観によって白さを決定した。対照の制汗剤は塗布後５～１０分以内に強い白さを示した。制汗剤Ｂは対照よりも白さが低減していた。制汗剤Ｂはまた、スティックに親指の圧力をかけたときに化粧品流体を保持する優れた能力も示した。また、この配合のスティックの剛性と弾性も改良されていた。さらに、滑らかな皮膚の感触を示し、パウダー状の仕上がりであった。配合Ｂはまた、より良好でより均一なマトリックスを提供しステアリルアルコール結晶化マトリックスの生長を低下させることによって有機ゲル化剤の結晶化も改善した。

【００７６】

化粧品実施例２

【００７７】

【表２】

組成	A	B (実施例 2)
A 部	wt%	wt%
プロピレングリコール	42.2	42.2
ヒドロキシプロピルセルロース	0.5	0.5
DBS	2	2
B 部		
プロピレングリコール中 30% Al Zr ペンタクロロハイドレックス gly	30	30
C 部		
SF1202	10	0
ExpMJO-07-465	0	10
SF1555	15	15
D5 中 40% ジメチコーンコポリオール	0.3	0.3

【００７８】
これらの透明な制汗スティックを製造すべく、プロピレングリコールを８０℃に加熱し、ヒドロキシプロピルセルロース（ＨＰＣ）にゆっくりと振りかけた。ＨＰＣが均一に分散した後混合物を１３０℃に加熱し、ＤＢＳをバッチに加えた。このグリコール混合物が１００℃に冷えたとき制汗活性剤溶液を加えた。別に、シリコーン相すなわちＣ部を混合し８０℃に加熱した後、このシリコーン相にグリコール相をゆっくり導入した。

【００７９】
本発明の透明な制汗剤Ｂはシネレシスを示さず、そのスティックの剛性は対照と比較して増大していた。また、対照に比べると、繰出し性が良好で、皮膚に対して制汗活性剤が滑らかで均一に付着した。

【００８０】
化粧品実施例３及び４

【００８１】
【表３】

成分	A	B (実施例 3)	C	D (実施例 4)
A 部	Wt%	Wt%	Wt%	Wt%
SF1202	21.65	11.65	19.2	9.9
イソドデカン	8.7	8.7		
カプリル酸/カプリン酸トリグリセリド	3.6	3.6		
ジメチコーン			9.3	9.3
フェニルトリメチコーン			9.3	9.3
ソルビタンオレエート	1.5	1.5	1.4	1.4
D5 中 40% ジメチコーンコポリオール	3.75	3.75	3.5	3.5
ExpMJO-07-465		10		
ExpMJO-07-434				9.3
B 部				
鉄酸化物 (赤, 黄, 黒)	2.34	2.34	2.18	2.18
TiO_2	8.73	8.73	8.11	8.11
D5 中 10% ジメチコーンコポリオール	6.63	6.63	6.15	6.15
C 部				
脱イオン水	37.75	37.75	34.98	34.98
ブチレングリコール	5	5	4.65	4.65
キサンタンガム	0.1	0.1	0.1	0.1
C_{11-15} Pareth-7	0.25	0.25	0.23	0.23
硫酸マグネシウム			0.9	0.9

【００８２】

【表４】

パラメーター	ファンデーションA	ファンデーションB (実施例 3)	ファンデーションC	ファンデーションD (実施例 4)
カバー度[1]	-	優	-	優
光沢	3.2	3.2	17.2	11.6
ウォッシュオフ 5 サイクル後の外観[2]	NA	NA	洗い落ちた	部分的に洗い落ちたが、残ったファンデーションはパウダー状仕上がりを示した

注: 1 = カバー度は対照との対比で行った。ファンデーション A はファンデーション B の対照であり、ファンデーション C はファンデーション D の対照であった。

2 = ファンデーション C 及び D は、ビニルスライド上に塗布したファンデーションのウォッシュオフ 5 サイクル後の外観を評価した。ウォッシュオフ耐性に関する方法は ASTM D1913 に記載されている。

【００８３】

これらのファンデーションを製造すべく、Ａ部とＢ部を室温で均一になるまで一緒に混合した。水相（Ｃ部）を油相に添加するとエマルジョンが生成した。ビニルスライド上２４ミクロンの厚さでファンデーション試料のカバー力を評価した。すべてのファンデーションのドローダウン中の塗り易さ、外観、カバー度及び艶を評価した。艶は、１２時間後に光沢計を用いて決定した。この研究でファンデーションＢはファンデーションＡ（対照）に対して、そしてファンデーションＤはファンデーションＣ（対照）に対して評価した。

【００８４】

ファンデーションＢはビニルスライド上で線と欠陥の出現が減り、最初のこすり取る際のシャインが低減することで、優れた均一なカバー力を与えた。ただし、ファンデーション

ＡとＢはいずれも１２時間後光沢に変化がなかった。ファンデーションＢは贅沢なシルキー感触を与え、パウダー状の仕上げ外観を呈した。本発明のファンデーションＢは、室温で１週間後、同時にシネレシスを示したファンデーションＡ（対照）と比べて改良された安定性をもっていた。

【００８５】

ファンデーションＤはファンデーションＢについて記載したのと類似の効果を示した。またこのファンデーションはウォッシュオフ耐性も示し、このためパーソナルケア製品は発汗に対し、又は水泳中の持続性が向上した。ファンデーションＤは上記結果に見られるように艶を調節する能力をもっていた。

【００８６】

化粧品実施例５及び６

これらの２つの例は、本発明のシリコーンゲルの有機相溶性を示すために調製し、シクロペンタシロキサン（及び）ジメチコーン／ビニルジメチコーンクロスポリマー（ＳＦＥ８３９）というＩＮＣＩ名を有する現存のエラストマーゲルと比較した。

【００８７】

化粧品実施例５

【００８８】

【表５】

組成	外観
SFE839 中 25% ペトロラタム	液体
ExpMJO-07-465 中 25% ペトロラタム	ゲル

【００８９】

ペトロラタムをＳＦＥ８３９と混合するとその配合品は構造を失い、不透明な流体混合物となった。すなわち、ペトロラタムとＳＦＥ８３９の不相溶性を示した。一方、ペトロラタムを本発明のゲル中に混入するとゲルは製品の一体性を維持する能力があり、このゲルとペトロラタムの相溶性を示していた。

【００９０】

化粧品実施例６

【００９１】

【表６】

組成	外観
SFE839 中 50% セテアリルメチコーン	非相容性
ExpMJO-07-465 中 50% セテアリルメチコーン	相容性

【００９２】

セテアリルメチコーンは線状アルキル置換シリコーンであり、皮膚上に吸蔵性バリヤーを創成することにより配合物に対して保湿性を与える。このシリコーンモイスチャライザーを新規なゲルと一緒にすると良好な相溶性を示したが、ＳＦＥ８３９は相溶性を示さなかった。また、本発明のゲルは、ＳＦＥ８３９で必要とされる高剪断ミキサー又は長い混合時間を必要としないという点で化粧品成分とブレンドするのがより容易である。

【００９３】

化粧品実施例７

このスキントリートメントゲルは、下記の成分全部を室温で均一になるまで一緒にすることによって製造した。このゲルを皮膚処理用の送達系として使用した。このゲルは製造中加熱を必要としないので熱感受性と非熱感受性の活性成分の両方として適している。この配合品中には水がないため、ビタミンＣの効力が使用するまで確保される。

【００９４】

【表７】

組成	wt%
ポリメチルシルセスキキサン (Tospearl 2000B)	0.5
ビタミンC	1
水添ポリデセン	10
ExpMJO-07-434	88.5

【００９５】

化粧品実施例８

下記成分を含むリップトリートメントは輪郭形成、持続性及び保湿感触に有用である。

【００９６】

【表８】

組成	wt%
ExpMJO-07-465	89
フェニルプロピルジメチルシロキシシリケート	10
ナイロン-12	1

【００９７】

化粧品実施例９

シルキーなボディーローションを製造すべく、Ａ部を一緒にし、８０℃に加熱する。別の容器で、Ｂ部を混合し、７５℃に加熱する。高剪断混合下でＡ部とＢ部を一緒に加えるとエマルジョンが生成する。このローションでは明るくすべすべした皮膚感触が得られる。

【００９８】

【表９】

組成	
A部	wt%
ExpMJO-07-465	10
カプリル酸/カプリン酸トリグリセリド	5
C_{30-45}アルキルジメチコーン	5
グリセリルステアレート(及び)PEG-100 ステアレート	4
B部	
水	十分量
キサンタンガム	0.1
グリセリン	2
保存料, 着色剤, 香料	1

【００９９】

化粧品実施例１０～１３

室温でＡ部とＢ部とを一緒にすることにより各種パーソナルケア製品用の耐水性ローションを製造した。次にこれらローションをガラススライドに塗り、ＡＳＴＭ　Ｄ１９１３に記載の方法を用いて耐水性の程度を試験した。ウォッシュオフ耐性の程度は、ローションが完全に洗い落とされるまでのウォッシュオフサイクルの数である。以下に示すように、本発明の新規なゲルを含むボディーローションＢ～Ｅは耐水性を示した。

【０１００】

【表１０】

組成	A	B	C	D	E
化粧品実施例	対照	10	11	12	13
A 部	wt%	wt%	wt%	wt%	wt%
ソルビタンオレエート	0.6	0.6	0.6	0.6	0.6
D5 中 10% ジメチコーンコポリオール	10	10	10	10	10
SF1202	16	4	4	4	4
ExpMJO-07-401	0	12	0	0	0
ExpMJO-07-437	0	0	12	0	0
ExpMJO-07-434	0	0	0	12	0
ExpMJO-07-438	0	0	0	0	12
B 部					
グリセリン	1	1	1	1	1
塩化ナトリウム	1	1	1	1	1
Quaternium-15	0.1	0.1	0.1	0.1	0.1
水	十分量	十分量	十分量	十分量	十分量

ウォッシュオフ耐性結果

組成物	ウォッシュオフ回数
A (対照)	5
B	15
C	15
D	15
E	10

【０１０１】

化粧品実施例１４

下記成分を含むヘアシャンプーは毛髪繊維にシルキーな感触を与える。このシャンプーは２通りに製造することができる。１つは、シャンプーに直接シリコーンゲルを加える。他方は、シリコーンゲルをエマルジョンが生成するまで少なくとも１種の界面活性剤及び水とプレブレンドし、そのシリコーンゲルエマルジョンをシャンプーに加える。

【０１０２】

このシャンプーは、次の成分を以下の順に混合することにより製造する。

【０１０３】

【表１１】

組成	wt%
ラウリル硫酸アンモニウム	35
コカミドプロピルベタイン	5
水	56.6
保存料	0.01
アクリレート/$C_{10\text{-}30}$アルキルアクリレート架橋ポリマー	0.8
水酸化ナトリウム	pH 7.5 に調整
ExpMJO-07-465	2.5
クエン酸	pH 6 に調整

【０１０４】

化粧品実施例１５

このデイリーユーズヘアコンディショナーは軟らかさ、滑らかさ及び腰の強さ(body)を与える。

【０１０５】

【表１２】

組成	wt%
脱イオン水	93
ヒドロキシエチルセルロース	1.5
シリコーンゲルエマルジョン	2
塩化セトリモニウム	3
保存料, 着色剤, 香料	十分量

【０１０６】

化粧品実施例１６

このリーブオンヘアコンディショナーはばさつきを低下させ、腰の強さ及びボリューム感を増大する。

【０１０７】

【表１３】

組成	wt%
ExpMJO-07-465	50
ジメチコーンコポリオール	5
イソドデカン	45

【０１０８】

化粧品実施例１７

この軟らかい固体制汗剤は抗シネレシス性の増粘・知覚向上剤としてシリコーンゲルを含有している。このゲルは優れた有機相溶性を示す。これは所望の肌触りと剛さを達成するために有機増粘剤と組み合わせて用いられる。

【０１０９】

【表１４】

成分	部/重量 (%)
シクロペンタシロキサン (SF1202)	37.0
ジメチコーン (SF96-10)	8.0
安息香酸 C12-15 アルキル	8.0
水添ひまし油 (mp 70°C)	7.0
C18-36 酸トリグリセリド	7.0
ExpMJO-07-484	5.0
タルク	3.0
アルミニウムジルコニウムテトラハイドレックス gly	25.0

【０１１０】

化粧品実施例１８

このシリコーンリップスティックは唇を軟らかくするためにシリコーンゲルを含有している。独特な軟らかいシルキー感触を与える２種のシリコーン、すなわちＳＦ１５２８とＥｘｐ－ＭＪＯ－０７－４８４とがある。太陽光から保護するための配合には日焼け止めを加えることができよう。

【０１１１】

【表１５】

成分	部/重量(%)
シクロペンタシロキサン(及び) PEG/PPG-20/15 ジメチコーン (SF1528)	20.0
ExpMJO-07-484	40.0
C18-36酸トリグリセリド	5.0
オゾケライト	3.0
ポリエテン	5.0
イソドデカン	20.0
D&C レッド No.7 Ca レーキ	7.0

【０１１２】
ＳＦｘｘｘｘという材料はＧＥ　Ｓｉｌｉｃｏｎｅｓ社（米国ニューヨーク州ウオーターフォード、ハドソン・リバー・ロード２６０）から市販されているシリコーン材料である。

【０１１３】
以上の実施例は単に例示のために挙げたものであり、いかなる意味でも特許請求の範囲を限定するものではない。当業者は、本明細書に記載の主題と開示範囲に対して、当技術分野の通常の知識に基づき特許請求の範囲の正確又は公正な範囲内に入る自明な変形をなすことができるものと考えられる。

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(54) Title: COSMETIC COMPOSITIONS USING POLYETHER SILOXANE COPOLYMER NETWORK COMPOSITIONS

(57) Abstract: A composition comprising the reaction products of $M_aM^H_bM^E_cD_dD^H_eD^E_fT_gT^H_hT^E_iQ_j$ Where $M = R^1R^2R^3SiO_{1/2}$; $MH=R4R^5H\,SiO_{1/2}$; $M^E=R^6R^7R^ESiO_{1/2}$; $D=R^8R^9SiO_{2/2}$; $D^H=R^{10}HsiO_{2/2}$; $D^E=R^{11}R^ESiO^{2/2}$; $T=R^{12}SiO_{3/2}$; $T^H = HsiO_{3/2}$; $T^E=R^ESiO_{3/2}$; and $Q=SiO_{4/2}$; where R^1, R^2, R^3, R^8, R^9, and R^{12} are independently monovalent hydrocarbon radical having from one to sixty carbon atoms; R^4, R^5 and R^{10} are independently monovalent hydrocarbon radicals having from one to sixty carbon atoms or hydrogen; R^6, R^7 and R^{11} are independently monovalent hydrocarbon radicals having form one sixty carbon atoms or R^E; each R^E is independently a monovalent hydrocarbon radical containing one or more oxirane moieties having form one to sixty carbon atoms; the stoichiometric subscripts a, b, c, d, e, f, g, h, i, and j are either zero or positive subject to the following limitations $a + b + c > 1$; $b + e + h > 1$; $c + f + I > 1$; $b + e + h > c + f + I$; and when $d + e + f + g + h + I + j = 0$, $a + b + c = 1$. In a preferred embodiment the reaction product of the present invention is a polyether siloxane copolymer network. In another preferred embodiment the reaction product of the present invention is a polyether siloxane copolymer network swollen with a volatile low molecular weight silicon containing compound. These compositions are useful for a variety of personal care compositions.

COSMETIC COMPOSITIONS USING POLYETHER SILOXANE COPOLYMER NETWORK COMPOSITIONS

FIELD OF THE INVENTION

The present invention relates to silicone compositions, more particularly to compositions comprising a silicone polymer network comprising cross-links derived from epoxide or oxirane moieites.

BACKGROUND OF THE INVENTION

The personal care industry thrives on being able to deliver multiple performance products based on mixtures of several components, with each having performance characteristics important to or desirable in the final formulation. One desirable characteristic is the ability to provide a silky initial feel derived from low molecular weight silicones, such as for example, octamethylcyclotetrasilioxane or decamethylcyclopentasiloxane, in the formulation while maintaining a high, but shear-thinnable viscosity. While these low molecular weight silicones provide the desired feel characteristics, they are also low viscosity, highly flowable liquids. Thus they are not easily held in a formulation, preferring rather to separate and flow out of a given container or flow uncontrollably across the skin when used in a specific application. Further, it desirable to achieve an initial silky feel while providing a smooth, low-residue feel upon dry-down. Polymeric silicone gels prepared in volatile silicone have been found to deliver desirable initial feel of volatile, low viscosity silicones to formulations while at the same time provide high viscosity and a smooth silky feel on dry-down, see for example, US Patent Nos.5,760,116, 5,493,041 and 4,987,169.

Such polymeric silicone gels have typically been made by the hydrosilylation reaction, which requires the use of both SiH functional groups and terminal olefinic groups to form crosslinked siloxane polymers. Thus only siloxane structures that can incorporate silylhydride groups and optionally, vinyl functional siloxane groups, can be utilized in making these materials. Further this method of generating crosslinked siloxane polymers limits the range of desirable organofunctional groups that may be incorporated into the polymeric structure to create additional performance advantages in complex formulations. Thus attempts to include organofunctional groups into the crosslinked siloxane polymer include unsaturated organic groups compatible with the hydrosilylaton reaction.

SUMMARY OF THE INVENTION

A cosmetic composition comprising the reaction products of

$M_aM^H_bM^E_cD_dD^H_eD^E_f T_gT^H_hT^E_iQ_j$

where

$M = R^1R^2R^3SiO_{1/2}$;

$M^H = R^4R^5H\ SiO_{1/2}$;

$M^E = R^6R^7R^ESiO_{1/2}$;

$D = R^8R^9SiO_{2/2}$;

$D^H = R^{10}HSiO_{2/2}$;

$D^E = R^{11}R^ESiO_{2/2}$;

$T = R^{12}SiO_{3/2}$;

$T^H = HSiO_{3/2}$;

$T^E = R^ESiO_{3/2}$; and

$Q = SiO_{4/2}$;

where R^1, R^2, R^3, R^8, R^9 and R^{12} are independently monovalent hydrocarbon radicals having from one to sixty carbon atoms; R^4, R^5 and R^{10} are independently monovalent hydrocarbon radicals having from one to sixty carbon atoms or hydrogen; R^6, R^7, R^{11} are independently monovalent hydrocarbon radicals having from one to sixty carbon atoms or R^E; each R^E is independently a monovalent hydrocarbon radical containing one or more oxirane moieties having from one to sixty carbon atoms; the stoichiometric subscripts a, b, c, d, e, f, g, h, i, and j are either zero or positive subject to the following limitations: $a + b + c > 1$; $b + e + h > 1$; $c + f + i > 1$; $b + e + h > c + f + i$; and when $d + e + f + g + h + i + j = 0$, $a + b + c = 2$. In a preferred embodiment the reaction product of the present invention is a polyether siloxane copolymer network. In another preferred embodiment the reaction product of the present invention is a polyether siloxane copolymer network swollen with a volatile low molecular weight silicon containing compound. These compositions are useful for a variety of personal care compositions.

DETAILED DESCRIPTION OF THE INVENTION

The compositions of the present invention comprise the reaction products of an epoxy functional hydrido siloxane molecule having the following formula:

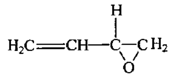
$M_aM^H_bM^E_cD_dD^H_eD^E_f T_gT^H_hT^E_iQ_j$
where
$M = R^1R^2R^3SiO_{1/2}$;
$M^H = R^4R^5H\ SiO_{1/2}$;
$M^E = R^6R^7R^ESiO_{1/2}$;
$D = R^8R^9SiO_{2/2}$;
$D^H = R^{10}HSiO_{2/2}$;
$D^E = R^{11}R^ESiO_{2/2}$;
$T = R^{12}SiO_{3/2}$;
$T^H = HSiO_{3/2}$;
$T^E = R^ESiO_{3/2}$; and
$Q = SiO_{4/2}$;

where R^1, R^2, R^3, R^8, R^9 and R^{12} are independently monovalent hydrocarbon radicals having from one to sixty carbon atoms; R^4, R^5 and R^{10} are independently monovalent hydrocarbon radicals having from one to sixty carbon atoms or hydrogen; R^6, R^7 , R^{11} are independently monovalent hydrocarbon radicals having from one to sixty carbon atoms or R^E; each R^E is independently a monovalent hydrocarbon radical containing one or more oxirane moieties having from one to sixty carbon atoms; the stoichiometric subscripts a, b, c, d, e, f, g, h, i, and j are either zero or positive subject to the following limitations: $a + b + c > 1$; $b + e + h > 1$; $c + f + i > 1$; $b + e + h > c + f + i$; and when $d + e + f + g + h + i + j = 0$, $a + b + c = 2$.

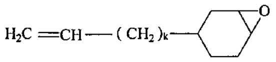
One method of producing the composition of the present invention is to react a molecule having the following formula:

$M_aM^H_{b'}D_dD^H_{e'}T_gT^H_{h'}Q_j$

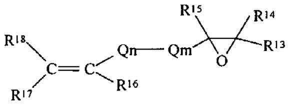
wherein the definitions and relationships are as later defined (and also consistent with those defined above) under hydrosilylation conditions with an olefinically unsaturated molecule containing one or more oxirane moieties under conditions of stoichiometry where the molar quantity of oxirane is less than the molar quantity of silyl hydride. As used herein the phrase "an olefinically unsaturated molecule containing one or more oxirane moieties" means a molecule possessing one or more interior, pendant or terminal carbon carbon double bonds simultaneously with one or more interior, pendant or terminal three membered oxygen containing heterocyclic rings (chemically the phrase "three membered oxygen containing heterocyclic ring" is used herein interchangeably with the oxirane or epoxide structures). The simplest chemical structure exemplified by such a definition is:



but also includes alicyclic structures exemplified by:

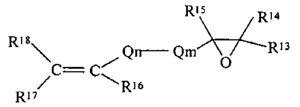


Where the subscript k may be zero or a positive integer, more preferably a positive integer ranging generally from 0 to about 10. It should be noted that both exemplified structures are terminal in both the olefinic moiety and the oxirane (epoxide) moiety. A more general chemical structure is:

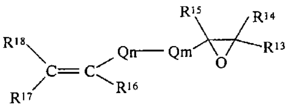


where R^{13}, R^{14}, R^{15}, R^{16}, R^{17} and R^{18} are each independently selected from the group of hydrogen and monovalent hydrocarbon radicals having from one to sixty carbon atoms, Q_m is a di- or trivalent hydrocarbon radical having from one to sixty carbon atoms, Q_n is a divalent hydrocarbon radical having from one to sixty carbon atoms with the subscripts m and n independently zero or one subject to the limitation that when Qm is trivalent one of R^{13} or R^{14} is absent and where R^{16} and R^{18} may be either cis- or trans- to each other.

Thus one possible synthetic pathway to prepare the reaction products of the present invention is as follows:

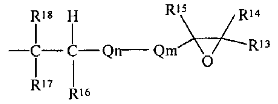


$M_aM^H_{b'}D_dD^H_{e'}T_gT^H_{h'}Q_j$ + α reacting under hydrosilylation conditions to yield $M_aM^H_bM^E_cD_dD^H_eD^E_fT_gT^H_hT^E_iQ_j$ when the stoichiometric coefficient, α, is less than the sum of b' + e' + h'. It should be noted that the stoichiometric coefficients b, e, and h define the quantity of hydride bearing species M^H, D^H and T^H in both reactant and product and are related one to other in that fashion but because some of the hydride bearing functions have reacted with an olefinically unsaturated molecule containing one or more oxirane moieties the following relationships must necessarily obtain: $b' + e' + h' > b + e + h$ and $b + c + e + f + h + i = b' + e' + h'$. It is to be noted that acetylene analogs of the olefinically unsaturated oxirane containing molecules will produce similar species that will react to form similar products. Thus as used herein the phrase an olefinically unsaturated molecule containing one or more oxirane moieties is intended to also include an acetylenically unsaturated molecule containing one or more oxirane moieties. The phrase "an acetylenically unsaturated molecule containing one or more oxirane moieties" means a molecule possessing one or more interior, pendant or terminal carbon carbon triple bonds simultaneously with one or more interior, pendant or terminal

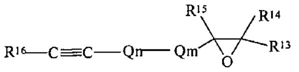


three membered oxygen containing heterocyclic rings (chemically the phrase "three membered oxygen containing heterocyclic ring" is used herein interchangeably with the oxirane or epoxide structures). When the epoxide compound is an olefinic epoxide, a specific example being:

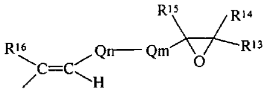
then R^E as a substituent, becomes



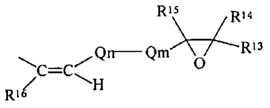
with all the definitions consistent with those as previously defined. When the epoxide is an acetylenic epoxide, a specific example being:



then R^E as a substituent, becomes either:



or



with all the definitions consistent with those as previously defined.

The silyl hydride bearing precursor molecule, $M_aM^H_{b'}D_dD^H_{e'}T_gT^H_{h'}Q_j$, can be prepared by a variety of techniques known in the art. Epoxy substituted siloxanes are prepared in the normal manner through the use of a hydrosilylation reaction to attach a vinyl or allyl substituted epoxide onto an SiH bearing siloxane. SiH containing siloxanes are well known in the art and can be linear, branched, or cyclic in structure. Examples of useful vinyl or allyl substituted epoxides include 4-vinyl cyclohexene oxide, allyl glycidyl ether, limonene oxide, 1,2-epoxy-5-hexene, 1,2-epoxy-7-octene, norbornadiene monoepoxide and 1,2-epoxy-9-decene. Precious metal catalysts suitable for making epoxy siloxanes are also well known in the art and comprise complexes of rhodium, ruthenium, palladium, osmium, iridium and /or platinum.

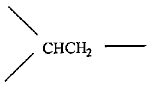
Many types of platinum catalysts for this SiH olefin addition reaction (hydrosilation or hydrosilylation) are known and such platinum catalysts may be used for the reaction in the present instance. When optical clarity is required the preferred platinum catalysts are those platinum compound catalysts that are soluble in the reaction mixture. The platinum compound can be selected from those having the formula ($PtCl_2$Olefin) and H($PtCl_3$Olefin) as described in U.S. patent number 3,159,601, hereby incorporated by reference. A further platinum containing material usable in the compositions of the present invention is the cyclopropane complex of platinum chloride described in U.S. patent number 3,159,662 hereby incorporated by reference. Further the platinum containing material can be a complex formed from chloroplatinic acid with up to 2 moles per gram of platinum of a member selected from the class consisting of alcohols, ethers, aldehydes and mixtures of the above as described in U.S. patent number 3,220,972 hereby incorporated by reference. The catalysts preferred for use are described in U. S. Patents numbers 3,715,334; 3,775,452; and 3,814,730 to Karstedt. Additional background concerning the art may be found at J. L. Spier, "Homogeneous Catalysis of Hydrosilation by Transition Metals, in Advances in Organometallic Chemistry, volume 17, pages 407 through 447, F.G.A. Stone and R. West editors, published by the Academic Press (New York, 1979). Persons skilled in the art can easily determine an effective amount of platinum catalyst. Generally, an effective amount ranges from about 0.1 to 50 parts per million of the total organopolysiloxane composition.

The reaction product of $M_aM^H_bM^E_cD_dD^H_eD^E_fT_gT^H_hT^E_iQ_j$ produces a polymer network, believed to be a polyether siloxane copolymer network (or alternativeley a siloxane polyether copolymer network). As used herein, the terminology "network" means a three dimensionally extending structure comprising interconnected polyether siloxane copolymer chains. Preferably, fluid is contained within interstices of the network. The term "interstices" is used herein in reference to a network to denote spaces within the network, that is, spaces between the polyether siloxane copolymer chains of the network. As used herein in the context of the polyether siloxane copolymer network, the term polyether is intended to include the reaction product of two or more epoxide moieties to form one or more ether linkages that form a cross link between siloxane chains or moieties.

In one preferred embodiment, the polyether siloxane copolymer network is a crosslinked network that is insoluble in the fluid component of the silicone composition of the present invention, but that is capable of being swollen by the fluid. The amount of crosslinking present in the crosslinked network may be characterized with respect to the degree of swelling exhibited by the network in the fluid. In another preferred embodiment, the crosslinked structure of the network is effective to allow the network to be swollen by a low molecular weight silicone fluid, such as, for example, decamethylcyclopentasiloxane, from its original volume to a swollen volume that is a factor of from 1.01 to 5000, more preferably from 2 to 1000, and even more preferably from 5 to 500, times its original volume. The original volume of the network can be determined, for example, by extracting or evaporating all of the fluid component from the silicone composition of the present invention to leave the original volume, that is, the volume of the polyether siloxane copolymer network in the absence of the fluid.

As used herein the terminology "hydrocarbon radical" includes acyclic hydrocarbon radicals, alicyclic hydrocarbon radicals and aromatic hydrocarbon radicals.

As used herein in reference to a hydrocarbon radical, the term "monovalent" means that the radical is capable of forming one covalent bond per radical, the term "divalent" means that the radical is capable of forming two covalent bonds per radical and the term "trivalent" means that the radical is capable of forming three covalent bonds per radical. Generally, a monovalent radical can be represented as having been derived from a saturated hydrocarbon compound by conceptual removal of one hydrogen atom from the compound, a divalent radical can be represented as having been derived from a saturated hydrocarbon compound by conceptual removal of two hydrogen atoms from the compound and a trivalent radical can be represented as having been derived from a saturated hydrocarbon compound by conceptual removal of three hydrogen atoms from the compound. For example, an ethyl radical, that is, a $-CH_2CH_3$ radical, is a monovalent radical; a dimethylene radical, that is, a $-(CH_2)_2-$ radical, is a divalent radical and an ethanetriyl radical, that is,



radical, is a trivalent radical, each of which can be represented as having been derived by conceptual removal of one or more hydrogen atoms from the saturated hydrocarbon ethane.

As used herein, the terminology "acyclic hydrocarbon radical" means a straight chain or branched hydrocarbon radical, preferably containing from 1 to 60 carbon atoms per radical, which may be saturated or unsaturated and which may be optionally substituted or interrupted with one or more atoms or functional groups, such as, for example, carboxyl, cyano, hydroxy, halo and oxy. As long as these functional groups do not interfere with the cationic cure mechanism of the epoxide or oxirane moiety, suitable monovalent acyclic hydrocarbon radicals may include, for example, alkyl, alkenyl, alkynyl, hydroxyalkyl, cyanoalkyl, carboxyalkyl, alkyloxy, oxaalkyl, alkylcarbonyloxaalkylene, carboxamide and haloalkyl, such as, for example, methyl, ethyl, sec-butyl, tert-butyl, octyl, decyl, dodecyl, cetyl, stearyl, ethenyl, propenyl, butynyl, hydroxypropyl, cyanoethyl, butoxy, 2,5,8-trioxadecanyl, carboxymethyl, chloromethyl and 3,3,3-fluoropropyl. Suitable divalent acyclic hydrocarbon radicals include, for example, linear or branched alkylene radicals, such as, for example, methylene, dimethylene, trimethylene, decamethylene, ethylethylene, 2-methyltrimethylene, 2,2-dimethyltrimethylene and linear or branched oxalkylene radicals such as, for example, methyleneoxypropylene. Suitable trivalent acyclic hydrocarbon radicals include, for example, alkanetriyl radicals, such as, for example, 1,1,2-

ethanetriyl, 1,2,4-butanetriyl, 1,2,8-octanetriyl, 1,2,4-cyclohexanetriyl and oxaalkanetriyl radicals such as, for example, 1,2,6-triyl-4-oxahexane.

As used herein the term "alkyl" means a saturated straight or branched monovalent hydrocarbon radical. In a preferred embodiment, monovalent alkyl groups are selected from linear or branched alkyl groups containing from 1 to 60 carbons per group, such as, for example, methyl, ethyl, propyl, iso-propyl, n-butyl, iso-butyl, sec-butyl, tert-butyl, pentyl, hexyl, heptyl, decyl, dodecyl.

As used herein the term "alkenyl" means a straight or branched monovalent terminally unsaturated hydrocarbon radical, preferably containing from 2 to 10 carbon atoms per radical, such as, for example, ethenyl, 2-propenyl, 3-butenyl, 5-hexenyl, 7-octenyl and ethenylphenyl.

As used herein, the terminology "alicyclic hydrocarbon radical" means a radical containing one or more saturated hydrocarbon rings, preferably containing from 4 to 12 carbon atoms per ring, per radical which may optionally be substituted on one or more of the rings with one or more alkyl radicals, each preferably containing from 2 to 6 carbon atoms per alkyl radical, halo radicals or other functional groups and which, in the case of a monovalent alicyclic hydrocarbon radical containing two or more rings, may be fused rings. Suitable monovalent alicyclic hydrocarbon radicals include, for example, cyclohexyl and cyclooctyl. Suitable divalent hydrocarbon radicals include, saturated or unsaturated divalent monocyclic hydrocarbon radicals, such as, for example, 1,4-cyclohexylene. Suitable trivalent alicyclic hydrocarbon radicals include, for example, cycloalkanetriyl radicals such as, for example, 1-dimethylene-2, 4-cyclohexylene, 1-methylethylene-3-methyl-3,4-cyclohexylene.

As used herein, the terminology "aromatic hydrocarbon radical" means a hydrocarbon radical containing one or more aromatic rings per radical, which may, optionally, be substituted on the aromatic rings with one or more alkyl radicals, each preferably containing from 2 to 6 carbon atoms per alkyl radical, halo radicals or other functional groups and which, in the case of a monovalent aromatic hydrocarbon radical containing two or more rings, may be fused rings. Suitable monovalent aromatic hydrocarbon radicals include, for example, phenyl, tolyl, 2,4,6-trimethylphenyl, 1,2-isopropylmethylphenyl, 1-pentalenyl, naphthyl, anthryl, eugenol and allylphenol as well as aralkyl radicals such as, for example, 2-phenylethyl. Suitable divalent aromatic hydrocarbon radicals include, for example, divalent monocyclic arenes such as, for example, 1,2-phenylene, 1,4-phenylene, 4-methyl-1,2-phenylene, phenylmethylene. Suitable trivalent aromatic hydrocarbon radicals include, for example, trivalent monocyclic arenes such as, for example, 1-trimethylene-3,5-phenylene.

In a preferred embodiment, the epoxy functional organosiloxane compound is reacted by polymerizing the epoxy functional organosiloxane compound under cationic polymerization conditions and, preferably, in the presence of a fluid, preferably a volatile siloxane fluid. In one embodiment, the epoxy functional organosiloxane compound is polymerized in the presence of a fluid to directly form the silicone composition of the present invention. In another embodiment, the epoxy functional organosiloxane compound is polymerized in the presence of a first fluid or fluid mixture to form a polyether siloxane copolymer network, and then the network so formed is subsequently swollen with a second fluid or fluid mixture to form the silicone composition of the present invention. The second fluid or fluid mixture may be the same as or different from the first fluid mixture. The first solvent may, optionally, be removed from the polymerized network by, for example, evaporation, prior to addition of the second fluid. As a further alternative, the epoxy functional organosiloxane compound is polymerized in the absence of a fluid to form a polyether siloxane copolymer network and the network is subsequently swollen with a fluid or mixture of fluids to form the silicone composition of the present invention. In another embodiment, the polymerization of the epoxy functional organosiloxane is conducted with a sufficient amount of excess hydridosiloxane functionality such that there is residual hydride remaining after polymerization that may be subsequently reacted under conditions suitable for hydrosilylation with one or more alkenyl functional compounds. This is especially advantageous in cases where the alkenyl functional compounds can act as inhibitors of cationic cure. Such alkenyl compounds are those that contain a functionality that can act as an inhibitor of the cationic cure mechanism, e.g. a base. In another embodiment, a small amount of a concentrated hydridosiloxane or hydridosilane compound is added in order to increase the rate of polymerization.

Cationic polymerization conditions can be generated by addition of an acid catalyst capable of polymerizing an epoxy group such as, for example, by addition of onium salt generated acids and certain metal salts, such as, for example, aluminum trichloride and ferric chloride, which act as Lewis acids or by addition of lanthanide triflates, see PCT Int. Appl. WO 0008,087. Acid catalyzed polymerization of epoxides is a well known method of forming organic polymers and has been applied to epoxy-functional siloxane compounds in order to form siloxane polyalkyleneoxide block copolymers for use in a variety of applications as, for example, release coatings on paper, see, for example, U.S. Patent No.4,279,717, and in conjunction with organic materials to form coatings and modified plastic compositions, see for example, U.S. Patent Nos. 5,354,796 and 5,663,752. One precautionary note must be observed, that is if the cationic polymerization is conducted in the presence of cyclic siloxanes, e.g. D_3, D_4 or D_5 and the like, the strength of the acid catalysis employed must be such that cationic polymerization of the epoxide moiety occurs but polymerization of the cyclic siloxane does not occur to any appreciable extent.

In a preferred embodiment, the epoxy functional organosiloxane compound is polymerized under cationic cure conditions generated through the interaction with platinum and an SiH-containing compound. This epoxide polymerization reaction route is described in U.S. Patent No. 5,128,431 and by J.V. Crivello and N. Fan, J. Polymer Sci., Part A: Polymer Chemistry, pp.1853-1863 (1997). In this embodiment, the reaction kinetics appear to be dependent upon the presence of trace quantities of molecular oxygen.

The polyether siloxane copolymer network compositions of the present invention produce a cross linked structure that possesses a certain amount of steric hindrance by reason of the cross links. This steric hindrance tends to prevent the reaction from going to completion even at long reaction times and thus a certain amount of residual functionality may remain. This residual functionality provides the ability to incorporate other functionality into the polyether siloxane copolymer network by reaction with functionalized molecules that are not as sterically constrained as the polyether siloxane copolymer network or it must be chemically inactivated. One reason the residual functionality might desirably be chemically inactivated is that in the processing of these materials as a polyether siloxane copolymer network swollen with a low molecular weight siloxane compound (or alternatively, low molecular weight silicone fluid), usually D_3, D_4, D_5, D_6 or $M'D'_qT'_sM'$ as later defined, is that processing under conditions of high shear tends to disrupt the network reducing the level of steric hindrance and thus could enable further cross linking reactions to occur because of the chemically exposed residual functionality. Post-cure cross linking is known to occur in addition polymerized silicones where the addition polymerization occurs via hydrosilylation. These materials are prepared by first hydrosilylation of a silyl hydride with an olefinic or acetylenic oxirane or epoxide compound. Thus a noble metal hydrosilylation catalyst will be present in the reaction mixture or within the interstices of the polyether siloxane copolymer network. This catalyst may be used to further polymerize the oxirane or epoxide moiety (moieties) incorporated in the reaction product producing the polyether siloxane copolymer network(s) of the present invention. The residual functionality remaining by design, i.e. by use of sub-stoichiometric quantities, or by reason of steric inhibition of reaction completion may be further reacted as taught herein or neutralized or inhibited. US patents 5,977,280 and 5,929,164, both herein incorporated by reference, teach such neutralization of hydrosilylation catalysts by treatment with strong noble metal complexing ligands, for example phosphines, amines and organic sulfur compounds such as organic sulfides and thiols. However, some of these strongly complexing ligands, while deactivating a noble metal hydrosilylation catalyst are toxic and thus their use must be avoided in some applications, e.g. personal care applications. Thus sulfur containing amino acid esters are strong noble metal complexing ligands and methionine methyl ester, methionine ethyl ester, cysteine methyl ester, cysteine ethyl ester and cysteine dimethyl ester have been preferred for such noble metal deactivation. It should be noted that naturally occuring proteins containing disulfide linkages that are easily disrupted may also be used to deactivate the noble metal catalysts employed, e.g. egg yolks and the like. Sulfur containing amino acid amides, polypeptides and the like may also function similarly to deactivate noble metal hydrosilylation catalysts.

The method of polymer synthesis provides for incorporation of a wide range of organofunctional groups into the copolymeric structure. Thus, the inclusion of other organofunctional groups, such as, for example, organic epoxides, epoxysiloxanes, terminally unsaturated organic and alkenylsiloxane compounds can be used to modify the resulting copolymers.

In an alternative embodiment, the organofunctional groups are introduced to the network during polymerization of the epoxyfunctional organosiloxane by including organofunctional compounds to the reaction mixture which are copolymerizable with the epoxy functional organosiloxane under the chosen polymerization reaction conditions.

In one embodiment, polymerization of the epoxy functional organosiloxane is conducted in the presence of one or more organic epoxide compounds which are copolymerizable with epoxy functional hydrido siloxanes under the polymerization conditions to form mixed polyalkyleneoxide units. The additional organic epoxide compounds may contain different substituents to further modify the resulting copolymer. Suitable organic epoxide compounds include, for example, ethylene oxide, propylene oxide, butylene oxide, cyclohexene oxide, glycidol and epoxide oils suchas for example epoxidized soybean oil.

In another embodiment, the polymerization of the epoxy functional organosiloxane is conducted in the presence of one or more hydroxyl functional compounds which are copolymerizable with epoxy functional hydrido siloxanes under the polymerization conditions to modify the product copolymer. Suitable hydroxyl functional compounds include, for example, water, hydroxy-stopped polyethers, organic alcohols, including organic diols, carbinol functional siloxanes and hydroxy functional organopolysiloxane polymers, including polyethersiloxane copolymers.

In another embodiment, the polymerization of the epoxy functional organosiloxane is conducted in the presence one or more alkenyl functional compounds which are copolymerizable with epoxy functional hydrido siloxanes under the polymerization conditions to modify the product copolymer. Suitable alkenyl functional compounds include alkenyl functional organic compounds, such as, for example, hexadiene, and alkenyl functional silicone compounds, such as for example, vinyl polydimethylsiloxanes. For example, an alkenyl-functional compound may conveniently be added via hydrosilylation in those embodiments in which the cationic reaction conditions for reacting the epoxide groups are generated using platinum and a hydrido-substituted siloxane, as described above.

The silicone composition may be further processed under low to high shear to adjust the viscosity and sensory feel of the composition. This may be achieved, for example, by subjecting the composition to a moderate to high shearing force. High shear may be applied using, for example, a Sonolator apparatus, a Gaulin Homogenizer or a Micro Fluidizer apparatus. Optionally, one or more fluids may be added to the silicone composition prior to the shearing.

In a preferred embodiment, the silicone composition of the present invention is a solid, typically having a creamy consistency, wherein the copolymer network acts as a means for gelling the fluid to reversibly impart characteristics of a solid to the fluid. At rest, the silicone composition exhibits the properties of a solid gel material. The silicone composition of the present invention exhibits high stability and resistance to syneresis, that is, the composition exhibits little or no tendency for fluid to flow from the composition and imparts high stability and syneresis resistance to personal care compositions which include the silicone composition as a component. The high stability and syneresis resistance persists with prolonged aging of such silicone compositions and personal care compositions. However, fluid may be released from the network by subjecting the silicone composition to a shearing force, such as, for example, by rubbing the composition between one's fingers, to provide improved sensory feel characteristic of the fluid component of the silicone material.

Fluids suitable for use as the fluid component of the composition of the present invention are those compounds or mixtures of two or more compounds that are in the liquid state at or near room temperature, for example, from about 20°C about 50°C, and about one atmosphere pressure, and include, for example, silicone fluids, hydrocarbon fluids, esters, alcohols, fatty alcohols, glycols and organic oils. In a preferred embodiment, the fluid component of the composition of the present invention exhibits a viscosity of below about 1,000 cSt, preferably below about 500 cSt, more preferably below about 250 cSt, and most preferably below 100 cSt, at 25 °C.

In a preferred embodiment, the fluid component of the present invention comprises an emollient compound. Suitable emollient compound include any fluid that provides emollient properties, that is, that when applied to skin, tend to remain on the surface of the skin or in the stratum corneum layer of the skin to act as lubricants , reduce flaking and to improve the appearance of the skin. Emollient compound are generically known and include, for example, hydrocarbons, such as for example, isododecane, isohexadecane and hydrogenated polyisobutene, organic waxes, such as for example, jojoba, silicone fluids, such as, for example, cyclopentasiloxane, dimethicone and bis-phenylpropyl dimethicone, esters, such as, for example, octyldodecyl neopentanoate and oleyl oleate, as well as fatty acids and alcohols, such as for example, oleyl alcohol and isomyristyl alcohol.

In a highly preferred embodiment, the fluid component of the present invention comprises a silicone fluid, more preferably a silicone fluid that exhibits emollient properties, preferably a low molecular weight silicone fluid or alternatively a low molecular weight siloxane compound. Suitable silicone fluids include, for example, cyclic silicones of the formula D_r, wherein D, R^8 and R^9 are as previously defined, preferably with R^8 and R^9 chosen from the group consisting of monovalent one to six carbon atom monovalent hydrocarbon radicals, more preferably methyl, and r is an integer wherein $3 \leq r \leq 12$, such as, for example, hexamethylcyclotrisiloxane ("D_3"), octamethylcyclotetrasiloxane ("D_4"), decamethylcyclopentasiloxane ("D_5"), and dodecamethylcyclohexasiloxane ("D_6") as well as linear or branched organopolysiloxanes having the formula:

$M'D'_qT'_sM'$

wherein:

M' is $R^{19}_3SiO_{1/2}$;

D' is $R^{20}_2SiO_{2/2}$;

T' is $R^{21}SiO_{3/2}$

R^{19}, R^{20} and R^{21} are each independently alkyl, aryl or aralkyl containing from one to sixty carbon atoms;

q and s are each independently integers from 0 to 300, preferably from 0 to 100, more preferably from 0 to 50, and most preferably from 0 to 20.

In a preferred embodiment, the silicone composition of the present invention comprises, per 100 parts by weight ("pbw") of the silicone composition, from 0.1 to 99 pbw, more preferably from 0.5 pbw to 30 pbw and still more preferably from 1 to 15 pbw of the polyether siloxane copolymer network and from 1 pbw to 99.9 pbw, more preferably from 70 pbw to 99.5 pbw, and still more preferably from 85 pbw to 99 pbw of the fluid.

The polyether siloxane copolymer network compositions of the present invention may be utilized as prepared or as the silicone component in emulsions. As is generally known, emulsions comprise at least two immiscible phases one of which is continuous and the other which is discontinuous. Further emulsions may be liquids with varying viscosities or solids. Additionally the particle size of the emulsions may be render them microemulsions and when sufficiently small microemulsions may be transparent. Further it is also possible to prepare emulsions of emulsions and these are generally known as multiple emulsions. These emulsions may be:

1) aqueous emulsions where the discontinuous phase comprises water and the continuous phase comprises the polyether siloxane copolymer network of the present invention;

2) aqueous emulsions where the continuous phase comprises the polyether siloxane copolymer network of the present invention and the discontinuous phase comprises water;

3) non-aqueous emulsions where the discontinuous phase comprises a non-aqueous hydroxylic solvent and the continuous phase comprises the polyether siloxane copolymer network of the present invention; and

4) non-aqueous emulsions where the continuous phase comprises a non-aqueous hydroxylic organic solvent and the discontinuous phase comprises the polyether siloxane copolymer network of the present invention.

Non-aqueous emulsions comprising a silicone phase are described in US patent 6,060,546 and co-pending application US Ser. No. 09/033,788 filed

March 3,1998 the disclosures of which are herewith and hereby specifically incorporated by reference.

As used herein the term "non-aqueous hydroxylic organic compound" means hydroxyl containing organic compounds exemplified by alcohols, glycols, polyhydric alcohols and polymeric glycols and mixtures thereof that are liquid at room temperature, e.g. about 25 °C, and about one atmosphere pressure. The non-aqueous organic hydroxylic solvents are selected from the group consisting of hydroxyl containing organic compounds comprising alcohols, glycols, polyhydric alcohols and polymeric glycols and mixtures thereof that are liquid at room temperature, e.g. about 25 °C, and about one atmosphere pressure. Preferably the non-aqueous hydroxylic organic solvent is selected from the group consisting of ethylene glycol, ethanol, propyl alcohol, iso-propyl alcohol, propylene glycol, dipropylene glycol, tripropylene glycol, butylene glycol, iso-butylene glycol, methyl propane diol, glycerin, sorbitol, polyethylene glycol, polypropylene glycol mono alkyl ethers, polyoxyalkylene copolymers and mixtures thereof.

Once the desired form is attained whether as a silicone only phase, an anhydrous mixture comprising the silicone phase, a hydrous mixture comprising the silicone phase, a water-in-oil emulsion, an oil-in-water emulsion, or either of the two non-aqueous emulsions or variations thereon, the resulting material is usually a high viscosity cream with good feel characteristics, and high absorbance of volatile siloxanes. It is capable of being blended into formulations for hair care, skin care, antiperspirants, sunscreens, cosmetics, color cosmetics, insect repellants, vitamin and hormone carriers, fragrance carriers and the like.

The personal care applications where the polyether siloxane copolymer network of the present invention and the silicone compositions derived therefrom of the present invention may be employed include, but are not limited to, deodorants, antiperspirants, antiperspirant/deodorants, shaving products, skin lotions, moisturizers, toners, bath products, cleansing products, hair care products such as shampoos, conditioners, mousses, styling gels, hair sprays, hair dyes, hair color products, hair bleaches, waving products, hair straighteners, manicure products such as nail polish, nail polish remover, nails creams and lotions, cuticle softeners, protective creams such as sunscreen, insect repellent and anti-aging products, color cosmetics such as lipsticks, foundations, face powders, eye liners, eye shadows, blushes, makeup, mascaras and other personal care formulations where silicone components have been conventionally added, as well as drug delivery systems for topical application of medicinal compositions that are to be applied to the skin.

In a preferred embodiment, the personal care composition of the present invention further comprises one or more personal care ingredients. Suitable personal care ingredients include, for example, emollients, moisturizers, humectants, pigments, including pearlescent pigments such as, for example, bismuth oxychloride and titanium dioxide coated mica, colorants, fragrances, biocides, preservatives, antioxidants, anti-microbial agents, anti-fungal agents, antiperspirant agents, exfoliants, hormones, enzymes, medicinal compounds, vitamins, salts, electrolytes, alcohols, polyols, absorbing agents for ultraviolet radiation, botanical extracts, surfactants, silicone oils, organic oils, waxes, film formers, thickening agents such as, for example, fumed silica or hydrated silica, particulate fillers, such as for example, talc, kaolin, starch, modified starch, mica, nylon, clays, such as, for example, bentonite and organo-modified clays.

Suitable personal care compositions are made by combining, in a manner known in the art, such as, for example, by mixing, one or more of the above components with the polyether siloxane copolymer network, preferably in the form of the silicone composition of the present invention. Suitable personal care compositions may be in the form of a single phase or in the form of an emulsion, including oil-in-water, water-in-oil and anhydrous emulsions where the silicone phase may be either the discontinuous phase or the continuous phase, as well as multiple emulsions, such as, for example, oil-in water-in-oil emulsions and water-in-oil-in water-emulsions.

In one useful embodiment, an antiperspirant composition comprises the polyether siloxane copolymer network of the present invention and one or more active antiperspirant agents. Suitable antiperspirant agents include, for example, the Category I active antiperspirant ingredients listed in the U.S. Food and Drug Administration's October 10, 1993 Monograph on antiperspirant drug products for over-the-counter human use, such as, for example, aluminum halides, aluminum hydroxyhalides, for example, aluminum chlorohydrate, and complexes or mixtures thereof with zirconyl oxyhalides and zirconyl hydroxyhalides, such as for example, aluminum-zirconium chlorohydrate, aluminum zirconium glycine complexes, such as, for example, aluminum zirconium tetrachlorohydrex gly.

In another useful embodiment, a skin care composition comprises the polyether siloxane copolymer network, preferably in the form of silicone composition of the present invention, and a vehicle, such as, for example, a silicone oil or an organic oil. The skin care composition may, optionally, further include emollients, such as, for example, triglyceride esters, wax esters, alkyl or alkenyl esters of fatty acids or polyhydric alcohol esters and one or more the known components conventionally used in skin care compositions, such as, for example, pigments, vitamins, such as, for example, Vitamin A, Vitamin C and Vitamin E, sunscreen or sunblock compounds, such as, for example, titanium dioxide, zinc oxide, oxybenzone, octylmethoxy cinnamate, butylmethoxy dibenzoylm ethane, p-aminobenzoic acid and octyl dimethyl-p-aminobenzoic acid.

In another useful embodiment, a color cosmetic composition, such as, for example, a lipstick, a makeup or a mascara composition comprises the polyether siloxane copolymer network, preferably in the form of silicone composition of the present invention, and a coloring agent, such as a pigment, a water soluble dye or a liposoluble dye.

In another useful embodiment, the compositions of the present invention are utilized in conjunction with fragrant materials. These fragrant materials may be fragrant compounds, encapsulated fragrant compounds, or fragrance releasing compounds that either the neat compounds or are encapsulated. Particularly compatible with the compositions of the present invention are the fragrance releasing silicon containing compounds as disclosed in US patents 6,046,156; 6,054,547; 6,075,111; 6,077,923; 6,083,901; and 6,153,578; all of which are herein and herewith specifically incorporated by reference.

The uses of the compositions of the present invention are not restricted to personal care compositions, other products such as waxes, polishes and textiles treated with the compositions of the present invention are also contemplated.

Experimental Preparation of Polyether Siloxane Copolymer Network Compositions

Preparation Example 1. 494.5 g of a hydride fluid with approximate composition M^HD_{300} $D^H_4M^H$ was mixed with 5.5 g of vinyl cyclohexene oxide, 1500 g of decamethyl cyclopentasiloxane (D5), and 0.1 g of a platinum divinyltetramethyldisiloxane catalyst solution. The result was heated to 80

°C. After a couple of hours, an additional portion of platinum catalyst solution was added. The material was heated for a total of 4 hours at 80 °C. In this way a gel material ExpMJO-07-391 was obtained with a solids content of about 26%. 567 g of ExpMJO-07-391 was then mixed with 1433 g of additional D5. Then the result was passed twice through a Gaulin homogenizer at 4500 psi. The result, ExpMJO-07-401 had a solids content of about 7.3% and a viscosity of 24,200 cps. This material gave a very silky feel when rubbed on the skin.

Preparation Example 2. 300 g of a hydride fluid with approximate composition $M^HD_{337}\ D^H_{11.8}M^H$ was mixed with 3.94 g of vinyl cyclohexene oxide, 37 g of Gulftene C30+ Alpha Olefin Fraction from Chevron (herein defined when a substituent as C30+), 1022.8 g of decamethyl cyclopentasiloxane (D5), and 0.1 g of a platinum divinyltetramethyldisiloxane catalyst solution. The result was heated to 80 °C for 8 hours producing ExpMJO-07-433. This material had a solids content of about 25.5%. 587.5 g of ExpMJO-07-433 was then swollen with 1412.5 g of additional D5 and then passed through a Gaulin homogenizer at 4500 psi. The result, ExpMJO-07-434, had a solids content of about 7.4% and a viscosity of 45,000 cps. It also gave a silky feel when rubbed on the skin.

Preparation Example 3. 300 g of a hydride fluid with approximate composition $M^H_{1.73}D_{388}\ D^H_{6.9}M_{0.27}$ was mixed with 3.00 g of vinyl cyclohexene oxide, 9 g of Gulftene C30+ Alpha Olefin Fraction from Chevron, 936 g of decamethyl cyclopentasiloxane (D5), and 0.1 g of a platinum divinyltetramethyldisiloxane catalyst solution. The result was heated to 80 °C for 8 hours producing ExpMJO-07-422. This material had a solids content of about 25.7%. 591.4 g of ExpMJO-07-422 was then swollen with 1408.6 g of additional D5 and then passed through a Gaulin homogenizer at 4500 psi.

The result, ExpMJO-07-437, had a solids content of about 7.26% and a viscosity of 39,000 cps.

Preparation Example 4. 300 g of a hydride fluid with approximate composition $M^{H}_{1.73}D_{388}\ D^{H}_{6.9}M_{0.27}$ was mixed with 3.00 g of vinyl cyclohexene oxide, 3 g of a C-16/18 Alpha Olefin Fraction, 918 g of decamethyl cyclopentasiloxane (D5), and 0.1 g of a platinum divinyltetramethyldisiloxane catalyst solution. The result was heated to 80 °C for 8 hours producing ExpMJO-07-424. This material had a solids content of about 25.7%. 591.4 g of ExpMJO-07-424 was then swollen with 1408.6 g of additional D5 and then passed through a Gaulin homogenizer at 4500 psi. The result, ExpMJO-07-438, had a solids content of about 7.57% and a viscosity of 39,500 cps.

Preparation Example 5. 300 g of a hydride fluid with approximate composition $M^{H}D_{337}\ D^{H}_{11.8}M^{H}$ was mixed with 4.89 g of vinyl cyclohexene oxide, 26.4 g of Gulftene C30+ Alpha Olefin Fraction from Chevron, 733 g of decamethyl cyclopentasiloxane (D5), and 0.08 g of a platinum divinyltetramethyldisiloxane catalyst solution. The result was heated to 80 °C for 6 hours producing ExpMJO-07-464. This material had a solids content of about 30.84%. 533 g of ExpMJO-07-464 was then swollen with 967 g of additional D5 and then passed through a Gaulin homogenizer at 4500 psi. The result, ExpMJO-07-465, had a solids content of about 11% and a viscosity of 200,000 cps.

Preparation Example 6. 300 g of a hydride fluid with approximate composition $MD_{100}\ D^{H}_{10.5}M$ was mixed with 13.53 g of vinyl cyclohexene oxide, 34.84 g of Gulftene C30+ Alpha Olefin Fraction from Chevron, 647 g of decamethyl cyclopentasiloxane (D5), and 0.10 g of a platinum divinyltetramethyldisiloxane catalyst solution. The result was heated to 80°C for 6 hours producing ExpMJO-07-477. This material had a solids content of about 35.25%. 533 g of ExpMJO-07-464 was then swollen with 947 g of additional D5 and then passed through a Gaulin homogenizer at 4500 psi. The result, ExpMJO-07-482, had a solids content of about 12.69% and a viscosity of 16,500 cps.

Preparation Example 7. 316.4 g of a hydride fluid with approximate composition $M^HD_{200}\ D^H_{10.5}M^H$ was mixed with 7.56 g of vinyl cyclohexene oxide 7.00g of 4-allyl-2-methoxy-phenol, 840 g of decamethyl cyclopentasiloxane (D5), and 0.09 g of a platinum divinyltetramethyldisiloxane catalyst solution. The result was heated to 80 °C for 6 hours producing ExpMJO-08-537. 418 g of ExpMJO-08-537 was then swollen with 582 g of additional D5 and then passed through a Gaulin homogenizer at 8000 psi. The result, ExpMJO-08-540, had a solids content of about 12% and a viscosity of 198,000 cps.

Preparation Example 8. Example Showing Gelation Followed by Hydrosilyation. 300 g of a hydride fluid with approximate composition $M^HD_{337}\ D^H_{11.8}M^H$ was mixed with 3.94 g of vinyl cyclohexene oxide, 905.4 g of decamethyl cyclopentasiloxane (D5), and 0.1 g of a platinum divinyltetramethyl disiloxane catalyst solution. The result was heated to 80 °C for 4 hours with good mixing. A small sample of the gelled reaction mixture was taken out and analyzed by FTIR. This clearly showed that there was residual SiH remaining. Next, a mixture of 30 g of the di isostearic acid ester of trimethylolpropane monoallyl ether, 100g of D5 and 1 drop of Pt catalyst was added. The result was heated for another 2 hours at 80 °C. At this end of this time a gel was obtained (Gel E) which had a solids content of 25.1%. FTIR analysis showed that the size of the SiH stretch (ca. 2140 cm-1) had substantially decreased.

Preparation Example 9. Example Showing Addition of a Concentrated Hydridosiloxane. 300 g of a hydride fluid with approximate composition $M^H_{1.73}D_{388}\ D^H_{6.9}M_{0.27}$ was mixed with 3.00 g of vinyl cyclohexene oxide, 4.00 g of 4-allyl-2-methoxy-phenol, 20.8 g of Gulftene C30+ Alpha Olefin Fraction from Chevron, 984 g of decamethyl cyclopentasiloxane (D5), and 0.1 g of a platinum divinyltetramethyl disiloxane catalyst solution. The result was heated to 80 °C for an hour with good mixing. At this point, a mixture of 4 g of a trimethylsilyl stopped methyl hydrogen polsiloxane and 5 g decamethyl cyclopentasiloxane was added. With 3 minutes, the reaction mixture gelled. Heating was continued for 5 hours in order to ensure complete reaction.

Preparation Example 10 300 g of a hydride fluid with approximate composition $M^HD_{200}\ D^H_{10.5}M^H$ was mixed with 7.22 g of vinyl cyclohexene oxide, 34.1 g of Gulftene C30+ Alpha Olefin Fraction from Chevron, 796 g of decamethyl cyclopentasiloxane (D5), and 0.085 g of a platinum divinyltetramethyldisiloxane catalyst solution. The result was heated to 80 °C for 6 hours producing ExpMJO-07-481. 562 g of ExpMJO-07-481 was then swollen with a mixture of 938 g of additional D5 and 1.0 g of a 10% solution of methyl di(hydrogenated tallow)amine in Isopar C and then passed through a Gaulin homogenizer at 4500 psi. The result, ExpMJO-07-484, had a solids content of about 11.58% and a viscosity of 85,000 cps.

Experimental Preparation of Cosmetic Compositions Using Polyether Siloxane Copolymer Network Compositions

Cosmetic Example 1

Composition	wt% A(Control)	wt% B(Ex1)
Stearyl alcohol	15	15
Hydrogenated castor oil	5	5
Isododecane	10	10

SF1202	45	35
Talc	1	1
Al Zr Trichlorohydrex Gly	24	24
ExpMJO-07-465	0	10

These antiperspirant sticks were made by heating stearyl alcohol, hydrogenated castor oil, isododecane, SF1202 and ExpMJO-07-465 until the gellants were melted . Al Zr Trichlorohydrex gly was added to the batch at 70°C and mixed until uniform. Antiperspirants were poured to containers at about 60°C. The antiperspirant was evaluated for whiteness, ability to hold liquid, feel, and hardness of the stick. The whiteness was determined by applying antiperspirant onto dark color vinyl slides to mimic the consumer application methods. Vinyl test slides were air dried for 15 min and the whiteness was determined by appearance. The control antiperspirants showed intense whiteness within 5-10 min after application. The antiperspirant B showed whiteness reduction as compared to control. Antiperspirant B also demonstrated a superior ability to hold cosmetic fluid when using thumb pressure was applied to the sticks. It also improved the rigidity and resiliency of the stick in this formulation. In addition, it provided lubricious skin feel with powdery finish. Formulation B also modified the crystallization of organic gelling agents by providing a better and more uniform matrix and reducing the growth of stearyl alcohol crystallization matrix.

Cosmetic Example 2

Composition	A	B(Ex2)
Part A	wt%	wt%
Propylene glycol	42.2	42.2
Hydroxypropyl cellulose	0.5	0.5

DBS	2	2
Part B		
30% Al Zr Pentachlorohydrex gly in propylene glycol	30	30
Part C		
SF1202	10	0
ExpMJO-07-465	0	10
SF1555	15	15
40% Dimethicone copolyol in D5	0.3	0.3

These clear antiperspirant sticks were prepared by heating propylene glycol to 80°C and slowly sprinkling in hydroxypropyl cellulose(HPC). After the HPC was uniformly dispersed, the mixture was heated up to 130°C and DBS was added to the batch. The glycol mixture was cooled down to 100°C when a solution of the antiperspirant active was added. The silicone phase or part C was separately mixed and heated to 80°C and then the glycol phase was slowly introduced to the silicone phase.

The clear antiperspirant B in this invention showed no syneresis and increased stiffness of the stick compared to control. It gave good pay-out and smooth uniform deposition of antiperspirant active on the skin when compared to control.

Cosmetic Example 3 and 4

Ingredients	A	B(Ex3)	C	D(Ex4)
Part A	Wt%	Wt%	Wt%	Wt%
SF1202	21.65	11.65	19.2	9.9
Isododecane	8.7	8.7		
Caprylic/capric Triglyceride	3.6	3.6		
Dimethicone			9.3	9.3
Phenyl trimethicone			9.3	9.3
Sorbitan oleate	1.5	1.5	1.4	1.4
40% Dimethicone copolyol in D5	3.75	3.75	3.5	3.5
ExpMJO-07-465		10		
ExpMJO-07-434				9.3
Part B				
Iron oxides(red, yellow, black)	2.34	2.34	2.18	2.18
TiO_2	8.73	8.73	8.11	8.11
10% Dimethicone copolyol in D5	6.63	6.63	6.15	6.15
Part C				
Deionized water	37.75	37.75	34.98	34.98
Butylene glycol	5	5	4.65	4.65
Xanthan gum	0.1	0.1	0.1	0.1
C_{11-15} Pareth-7	0.25	0.25	0.23	0.23
Magnesium sulfate			0.9	0.9

Parameter	Foundation A	Foundation B(Ex3)	Foundation C	Foundation D(Ex4)
Degree of coverage[1]	-	Excellent	-	Excellent
Gloss	3.2	3.2	17.2	11.6
Appearance after 5 cycles of wash off [2]	NA	NA	Washed away	Partially washed away, the remaining foundation showed powdery finish.

Note: 1 = Degree of coverage was conducted against the control. Formulation A was the control of formulation B and formulation C was the control of formulation D.

2 = Formulation C and D was tested for appearance of foundation coated on vinyl slides after 5 cycles of wash off. The wash off resistance method was described in ASTM D1913.

The foundations were prepared by mixing part A and part B together at room temperature until uniform. The emulsion was developed when the water phase (Part C) was added into the oil phase. The foundation samples were evaluated for coverage on vinyl slides at 24 micron in thickness. All foundations were evaluated on ease of spreadability during draw down, appearance, degree of coverage and shine. Shine was determined by using gloss meter after 12 hours. In this study formulation B was evaluated against formulation A(control) and formulation D was evaluated against formulation C(control).

Formulation B gave superior uniform coverage by reducing the appearance of lines and imperfections on the vinyl slides, and by reducing shine during initial rub-out. However, both formulation A and B did not show the difference in gloss after 12 hours. Formulation B imparted a luxurious silky feel with a powdery finish appearance. The foundation B in this invention had improved stability after one week at room temperature compared to the formulation A(control) which showed syneresis at the same time.

Formulation D gave the similar benefits as described in formulation B. In addition, it also provided wash off resistance which made personal care products more durable to perspiration or during swimming. Formulation D had an ability to control shine as shown in the result above.

Cosmetic Example 5 and 6

These two examples were prepared to illustrate organic compatibility of silicone gel in this invention and compared it with the current elastomer gel with an INCI name of cyclopentasiloxane (and) dimethicone/vinyl dimethicone crosspolymer (SFE839).

Cosmetic Example 5

Composition	Appearance
25% Petrolatum in SFE839	fluid
25% Petrolatum in ExpMJO-07-465	gel

When petrolatum was mixed with SFE839, the formulation lost the structure and became an opaque fluid mixture. This suggested the incompatibility of petrolatum and SFE839. On the other hand, when petrolatum was incorporated into the gel of this invention, the gel had an ability to maintain product integrity, indicating the compatibility of this gel and petrolatum.

Cosmetic Example 6

Composition	Appearance
50% Cetearyl methicone in SFE839	Incompatible
50% Cetearyl methicone in ExpMJO-07-465	Compatible

Cetearyl methicone is a linear alkyl substituted silicone and it provides moisturization to the formulation by creating an occlusive barrier on the skin. When this silicone moisturizer was combined with the new gel, it showed good compatibility whereas the SFE839 did not. In addition, the gel according to this invention is easier to blend with cosmetic ingredients in that it does not require the high shear mixer or lengthy mixing time required by SFE839.

Cosmetic Example 7

This skin treatment gel was prepared by combining all ingredients listed below until uniform at room temperature. The gel was used as delivery system for skin treatment and it is suitable for both heat sensitive and non-heat sensitive active ingredients since it does not require heating during manufacturing. The absence of water in this formulation ensures the efficacy of vitamin C until used.

Composition	wt%
Polymethylsilsesquioxane(Tospearl2000B)	0.5
Vitamin C	1
Hydrogenated polydecene	10
ExpMJO-07-434	88.5

Cosmetic Example 8

A lip treatment comprising ingredients below is useful for contouring, durability and moisturization feel.

Composition	wt%
ExpMJO-07-465	89
Phenylpropyldimethylsiloxysilicate	10
Nylon-12	1

Cosmetic Example 9

Silky body lotion is made by combining part A together and heating to 80°C. In a separate vessel, part B is mixed and heated to 75°C. The emulsion is formed when part A and part B are added together under high shear mixing. This lotion provides light and lubricious skin feel.

Composition	
Part A	wt%
ExpMJO-07-465	10
Caprylic/capric triglyceride	5
C_{30-45} Alkyl Dimethicone	5
Glyceryl stearate(and) PEG-100 stearate	4
Part B	
Water	q.s.
Xanthan gum	0.1
Glycerin	2
Preservatives, color, fragrance	1

Cosmetic Examples 10-13

Water resistant lotions useful for various personal care products were prepared by combining part A and part B together at room temperature. The lotions were then applied on glass slides and tested for degree of water resistance using the method described in ASTM D1913. The degree of wash off resistance is the numbers of wash off cycles taken before the lotion was completely washed away. The body lotion B-E with the new gel in this invention showed water resistant benefit as shown below.

Composition	A	B	C	D	E
Cosmetic Examples	Control	10	11	12	13
Part A	wt%	wt%	wt%	wt%	wt%
Sorbitan oleate	0.6	0.6	0.6	0.6	0.6
10% Dimthicone copolyol in D5	10	10	10	10	10
SF1202	16	4	4	4	4
ExpMJO-07-401	0	12	0	0	0
ExpMJO-07-437	0	0	12	0	0
ExpMJO-07-434	0	0	0	12	0
ExpMJO-07-438	0	0	0	0	12

Part B

Glycerin	1	1	1	1	1
Sodium chloride	1	1	1	1	1
Quaternium-15	0.1	0.1	0.1	0.1	0.1
Water	q.s.	q.s.	q.s.	q.s.	q,s,

Wash off resistant result

Formulation	Cycles of wash off
A(control)	5
B	15
C	15
D	15
E	10

Cosmetic Example 14

Hair shampoo comprising ingredients below gives a silky feel to hair fibers. This shampoo can be prepared into 2 ways; one is directly add silicone gel to the shampoo, and the other is pre-blend silicone gel with at least one surfactant and water until emulsion developed and add silicone gel emulsion to the shampoo.

This shampoo is made by mixing ingredients as ordered.

Compositions	wt%
Ammonium lauryl sulfate	35
Cocamidopropyl betaine	5
Water	56.6
Preservative	0.01
Acrylate/C_{10-30} alkyl acrylate crosspolymer	0.8
Sodium hydroxide	adjust to pH 7.5

ExpMJO-07-465	2.5
Citric acid	adjust to pH 6

Cosmetic Example 15

This hair conditioner for daily use provides softness, lubricity and body.

Composition	wt%
Deionized water	93
Hydroxyethylcellulose	1.5
Silicone gel emulsion	2
Cetrimonium chloride	3
Preservatives, color, fragrance	q.s.

Cosmetic Example 16

The leave on hair conditioner reduces fly-away and increases body and volume.

Composition	wt%
ExpMJO-07-465	50
Dimethicone copolyol	5
Isododecane	45

Cosmetic Example 17

This soft solid antiperspirant contains silicone gel an anti-syneresis, thickening and sensory enhancer. The gel shows excellent organic compatibility. It is used in combination with an organic thickener to achieve the desired texture and rigidity.

Ingredient	Part/Wt (%)
Cyclopentasiloxane (SF1202)	37.0
Dimethicone (SF96-10)	8.0
C12-15 Alkyl Benzoate	8.0
Hydrogenated Castor Oil (mp 70°C)	7.0
C18-36 Acid Triglyceride	7.0
ExpMJO-07-484	5.0
Talc	3.0
Aluminum Zirconium Tetrachlorohydrex Gly	25.0

Cosmetic Example 18

This silicone lipstick contains silicone gel to soften lips. There are two silicones, SF1528, and Exp-MJO-07-484, which give a unique soft silky feel. Sunscreens could be added to the formulations for solar protection.

Ingredient	Part/Wt (%)
Cyclopentasiloxane (and) PEG/PPG-20/15 Dimethicone (SF1528)	20.0
ExpMJO-07-484	40.0
C18-36 Acid Triglyceride	5.0
Ozokerite	3.0
Polyethylene	5.0
Isododecane	20.0
D&C Red No.7 Ca Lake	7.0

Materials listed as SFxxxx are commercially available silicone materials available from GE Silicones, 260 Hudson River Road, Waterford NY 12188.

These examples are to be construed as exemplary in nature only and are not intended in any way to limit the appended claims. It is contemplated that a person having ordinary skill in the art would be able to produce obvious variations of the subject matter and disclosures herein contained that would be by reason of such ordinary skill within the literal or equitable scope of the appended claims.

CLAIMS

Having described the Invention that which is claimed is:

1. A cosmetic composition comprising the reaction product of:

$M_aM^H_bM^E_cD_dD^H_eD^E_f T_gT^H_hT^E_iQ_j$

where

$M = R^1R^2R^3SiO_{1/2}$;

$M^H = R^4R^5H SiO_{1/2}$;

$M^E = R^6R^7R^ESiO_{1/2}$;

$D = R^8R^9SiO_{2/2}$;

$D^H = R^{10}HSiO_{2/2}$;

$D^E = R^{11}R^ESiO_{2/2}$;

$T = R^{12}SiO_{3/2}$;

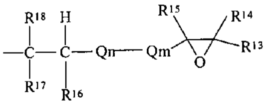
$T^H = HSiO_{3/2}$;

$T^E = R^ESiO_{3/2}$; and

$Q = SiO_{4/2}$;

where R^1, R^2, R^3, R^8, R^9 and R^{12} are independently monovalent hydrocarbon radicals having from one to sixty carbon atoms; R^4, R^5 and R^{10} are independently monovalent hydrocarbon radicals having from one to sixty carbon atoms or hydrogen; R^6, R^7, R^{11} are independently monovalent hydrocarbon radicals having from one to sixty carbon atoms or R^E; each R^E is independently a monovalent hydrocarbon radical containing one or more oxirane moieties having from one to sixty carbon atoms; the stoichiometric subscripts a, b, c, d, e, f, g, h, i, and j are either zero or positive subject to the following limitations: $a + b + c > 1$; $b + e + h > 1$; $c + f + i > 1$; $b + e + h > c + f + i$; and when $d + e + f + g + h + i + j = 0$, $a + b + c = 2$.

2. The composition of claim 1 where R^E has the formula:



where R^{13}, R^{14}, R^{15}, R^{16}, R^{17} and R^{18} are each independently selected from the group of hydrogen and monovalent hydrocarbon radicals having from one to sixty carbon atoms, Q_m is a di- or trivalent hydrocarbon radical having from one to sixty carbon atoms, Q_n is a divalent hydrocarbon radical having from one to sixty carbon atoms with the subscripts m and n independently zero or one subject to the limitation that when Qm is trivalent one of R^{13} or R^{14} is absent.

3. The composition of claim 1 where R^E is selected from the group consisting of 4-vinyl cyclohexene oxide, allyl glycidyl ether, limonene oxide, 1,2-epoxy-5-hexene, 1,2-epoxy-7-octene, norbornadiene monoepoxide and 1,2-epoxy-9-decene.

4. The composition of claim 2 where R^{13}, R^{14}, R^{15}, R^{16}, R^{17} and R^{18} are hydrogen and m and n are zero.

5. The composition of claim 3 where R^E is 4-vinyl cyclohexene oxide.

6. The composition of claim 1 where R^1, R^2, R^3, R^8, R^9 and R^{12} are independently selected from the group consisting of methyl, ethyl, sec-butyl, tert-butyl, octyl, decyl, dodecyl, cetyl, stearyl, ethenyl, propenyl, butynyl, hydroxypropyl, butoxy, 2,5,8-trioxadecanyl, carboxymethyl, chloromethyl, C30+ and 3,3,3-fluoropropyl.

7. The composition of claim 2 where R^1, R^2, R^3, R^8, R^9 and R^{12} are independently selected from the group consisting of methyl, ethyl, sec-butyl, tert-butyl, octyl, decyl, dodecyl, cetyl, stearyl, ethenyl, propenyl, butynyl, hydroxypropyl, cyanoethyl, butoxy, 2,5,8-trioxadecanyl, carboxymethyl, chloromethyl and 3,3,3-fluoropropyl.

8. The composition of claim 3 where R^1, R^2, R^3, R^8, R^9 and R^{12} are independently selected from the group consisting of methyl, ethyl, sec-butyl, tert-butyl, octyl, decyl, dodecyl, cetyl, stearyl, ethenyl, propenyl, butynyl, hydroxypropyl, cyanoethyl, butoxy, 2,5,8-trioxadecanyl, carboxymethyl, chloromethyl and 3,3,3-fluoropropyl.

9. The composition of claim 4 where R^1, R^2, R^3, R^8, R^9 and R^{12} are independently selected from the group consisting of methyl, ethyl, sec-butyl, tert-butyl, octyl, decyl, dodecyl, cetyl, stearyl, ethenyl, propenyl, butynyl, hydroxypropyl, cyanoethyl, butoxy, 2,5,8-trioxadecanyl, carboxymethyl, chloromethyl and 3,3,3-fluoropropyl.

10. The composition of claim 5 where R^1, R^2, R^3, R^8, R^9 and R^{12} are independently selected from the group consisting of methyl, ethyl, sec-butyl, tert-butyl, octyl, decyl, dodecyl, cetyl, stearyl, ethenyl, propenyl, butynyl, hydroxypropyl, cyanoethyl, butoxy, 2,5,8-trioxadecanyl, carboxymethyl, chloromethyl and 3,3,3-fluoropropyl.

11. A cosmetic composition comprising an aqueous emulsion where the discontinuous phase comprises water and the continuous phase comprises a composition comprising the reaction product of:

$M_aM^H{}_bM^E{}_cD_dD^H{}_eD^E{}_f\,T_gT^H{}_hT^E{}_iQ_j$

where

$M = R^1R^2R^3SiO_{1/2}$;

$M^H = R^4R^5H\ SiO_{1/2}$;

$M^E = R^6R^7R^ESiO_{1/2}$;

$D = R^8R^9SiO_{2/2}$;

$D^H = R^{10}HSiO_{2/2}$;

$D^E = R^{11}R^ESiO_{2/2}$;

$T = R^{12}SiO_{3/2}$;

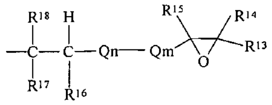
$T^H = HSiO_{3/2}$;

$T^E = R^ESiO_{3/2}$; and

$Q = SiO_{4/2}$;

where R^1, R^2, R^3, R^8, R^9 and R^{12} are independently monovalent hydrocarbon radicals having from one to sixty carbon atoms; R^4, R^5 and R^{10} are independently monovalent hydrocarbon radicals having from one to sixty carbon atoms or hydrogen; R^6, R^7, R^{11} are independently monovalent hydrocarbon radicals having from one to sixty carbon atoms or R^E; each R^E is independently a monovalent hydrocarbon radical containing one or more oxirane moieties having from one to sixty carbon atoms; the stoichiometric subscripts a, b, c, d, e, f, g, h, i, and j are either zero or positive subject to the following limitations: $a + b + c > 1$; $b + e + h > 1$; $c + f + i > 1$; $b + e + h > c + f + i$; and when $d + e + f + g + h + i + j = 0$, $a + b + c = 2$.

12. The composition of claim 11 where R^E has the formula:



where R^{13}, R^{14}, R^{15}, R^{16}, R^{17} and R^{18} are each independently selected from the group of hydrogen and monovalent hydrocarbon radicals having from one to sixty carbon atoms, Q_m is a di- or trivalent hydrocarbon radical having from one to sixty carbon atoms, Q_n is a divalent hydrocarbon radical having from one to sixty carbon atoms with the subscripts m and n independently zero or one subject to the limitation that when Qm is trivalent one of R^{13} or R^{14} is absent.

13. The composition of claim 11 where R^E is selected from the group consisting of 4-vinyl cyclohexene oxide, allyl glycidyl ether, limonene oxide, 1,2-epoxy-5-hexene, 1,2-epoxy-7-octene, norbornadiene monoepoxide and 1,2-epoxy-9-decene.

14. The composition of claim 12 where R^{13}, R^{14}, R^{15}, R^{16}, R^{17} and R^{18} are hydrogen and m and n are zero.

15. The composition of claim 13 where R^E is 4-vinyl cyclohexene oxide.

16. The composition of claim 11 where R^1, R^2, R^3, R^8, R^9 and R^{12} are independently selected from the group consisting of methyl, ethyl, sec-butyl, tert-butyl, octyl, decyl, dodecyl, cetyl, stearyl, ethenyl, propenyl, butynyl, hydroxypropyl, butoxy, 2,5,8-trioxadecanyl, carboxymethyl, chloromethyl, C30+ and 3,3,3-fluoropropyl.

17. The composition of claim 12 where R^1, R^2, R^3, R^8, R^9 and R^{12} are independently selected from the group consisting of methyl, ethyl, sec-butyl, tert-butyl, octyl, decyl, dodecyl, cetyl, stearyl, ethenyl, propenyl, butynyl, hydroxypropyl, cyanoethyl, butoxy, 2,5,8-trioxadecanyl, carboxymethyl, chloromethyl and 3,3,3-fluoropropyl.

18. The composition of claim 13 where R^1, R^2, R^3, R^8, R^9 and R^{12} are independently selected from the group consisting of methyl, ethyl, sec-butyl, tert-butyl, octyl, decyl, dodecyl, cetyl, stearyl, ethenyl, propenyl, butynyl, hydroxypropyl, cyanoethyl, butoxy, 2,5,8-trioxadecanyl, carboxymethyl, chloromethyl and 3,3,3-fluoropropyl.

19. The composition of claim 14 where R^1, R^2, R^3, R^8, R^9 and R^{12} are independently selected from the group consisting of methyl, ethyl, sec-butyl, tert-butyl, octyl, decyl, dodecyl, cetyl, stearyl, ethenyl, propenyl, butynyl, hydroxypropyl, cyanoethyl, butoxy, 2,5,8-trioxadecanyl, carboxymethyl, chloromethyl and 3,3,3-fluoropropyl.

20. The composition of claim 15 where R^1, R^2, R^3, R^8, R^9 and R^{12} are independently selected from the group consisting of methyl, ethyl, sec-butyl, tert-butyl, octyl, decyl, dodecyl, cetyl, stearyl, ethenyl, propenyl, butynyl, hydroxypropyl, cyanoethyl, butoxy, 2,5,8-trioxadecanyl, carboxymethyl, chloromethyl and 3,3,3-fluoropropyl.

21. A cosmetic composition comprising an aqueous emulsion where the discontinuous phase comprises water and the continuous phase comprises a composition comprising the reaction product of:

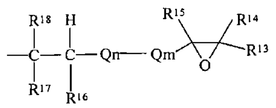
$M_aM^H_bM^E_cD_dD^H_eD^E_f T_gT^H_hT^E_iQ_j$

where

$M = R^1R^2R^3SiO_{1/2}$;
$M^H = R^4R^5H\ SiO_{1/2}$;
$M^E = R^6R^7R^ESiO_{1/2}$;
$D = R^8R^9SiO_{2/2}$;
$D^H = R^{10}HSiO_{2/2}$;
$D^E = R^{11}R^ESiO_{2/2}$;
$T = R^{12}SiO_{3/2}$;
$T^H = HSiO_{3/2}$;
$T^E = R^ESiO_{3/2}$; and
$Q = SiO_{4/2}$;

where R^1, R^2, R^3, R^8, R^9 and R^{12} are independently monovalent hydrocarbon radicals having from one to sixty carbon atoms; R^4, R^5 and R^{10} are independently monovalent hydrocarbon radicals having from one to sixty carbon atoms or hydrogen; R^6, R^7, R^{11} are independently monovalent hydrocarbon radicals having from one to sixty carbon atoms or R^E; each R^E is independently a monovalent hydrocarbon radical containing one or more oxirane moieties having from one to sixty carbon atoms; the stoichiometric subscripts a, b, c, d, e, f, g, h, i, and j are either zero or positive subject to the following limitations: $a + b + c > 1$; $b + e + h > 1$; $c + f + i > 1$; $b + e + h > c + f + i$; and when $d + e + f + g + h + i + j = 0$, $a + b + c = 2$.

22. The composition of claim 21 where R^E has the formula:



where R^{13}, R^{14}, R^{15}, R^{16}, R^{17} and R^{18} are each independently selected from the group of hydrogen and monovalent hydrocarbon radicals having from one to sixty carbon atoms, Q_m is a di- or trivalent hydrocarbon radical having from one to sixty carbon atoms, Q_n is a divalent hydrocarbon radical having from one to sixty carbon atoms with the subscripts m and n independently zero or one subject to the limitation that when Qm is trivalent one of R^{13} or R^{14} is absent.

23. The composition of claim 21 where R^E is selected from the group consisting of 4-vinyl cyclohexene oxide, allyl glycidyl ether, limonene oxide, 1,2-epoxy-5-hexene, 1,2-epoxy-7-octene, norbornadiene monoepoxide and 1,2-epoxy-9-decene.

24. The composition of claim 22 where R^{13}, R^{14}, R^{15}, R^{16}, R^{17} and R^{18} are hydrogen and m and n are zero.

25. The composition of claim 23 where R^E is 4-vinyl cyclohexene oxide.

26. The composition of claim 21 where R^1 , R^2, R^3, R^8, R^9 and R^{12} are independently selected from the group consisting of methyl, ethyl, sec-butyl, tert-butyl, octyl, decyl, dodecyl, cetyl, stearyl, ethenyl, propenyl, butynyl, hydroxypropyl, cyanoethyl, butoxy, 2,5,8-trioxadecanyl, carboxymethyl, chloromethyl, C30+ and 3,3,3-fluoropropyl.

27. The composition of claim 22 where R^1, R^2, R^3, R^8, R^9 and R^{12} are independently selected from the group consisting of methyl, ethyl, sec-butyl, tert-butyl, octyl, decyl, dodecyl, cetyl, stearyl, ethenyl, propenyl, butynyl, hydroxypropyl, butoxy, 2,5,8-trioxadecanyl, carboxymethyl, chloromethyl and 3,3,3-fluoropropyl.

28. The composition of claim 23 where R^1, R^2, R^3, R^8, R^9 and R^{12} are independently selected from the group consisting of methyl, ethyl, sec-butyl, tert-butyl, octyl, decyl, dodecyl, cetyl, stearyl, ethenyl, propenyl, butynyl, hydroxypropyl, cyanoethyl, butoxy, 2,5,8-trioxadecanyl, carboxymethyl, chloromethyl and 3,3,3-fluoropropyl.

29. The composition of claim 24 where R^1, R^2, R^3, R^8, R^9 and R^{12} are independently selected from the group consisting of methyl, ethyl, sec-butyl, tert-butyl, octyl, decyl, dodecyl, cetyl, stearyl, ethenyl, propenyl, butynyl, hydroxypropyl, cyanoethyl, butoxy, 2,5,8-trioxadecanyl, carboxymethyl, chloromethyl and 3,3,3-fluoropropyl.

30. The composition of claim 25 where R^1, R^2, R^3, R^8, R^9 and R^{12} are independently selected from the group consisting of methyl, ethyl, sec-butyl, tert-butyl, octyl, decyl, dodecyl, cetyl, stearyl, ethenyl, propenyl, butynyl, hydroxypropyl, cyanoethyl, butoxy, 2,5,8-trioxadecanyl, carboxymethyl, chloromethyl and 3,3,3-fluoropropyl.

31. A cosmetic composition comprising a non-aqueous emulsion where the discontinuous phase comprises a non-aqueous hydroxylic solvent and the continuous phase comprises a composition comprising the reaction product of:

$M_aM^H_bM^E_cD_dD^H_eD^E_f T_gT^H_hT^E_iQ_j$

where

$M = R^1R^2R^3SiO_{1/2}$;

$M^H = R^4R^5H\ SiO_{1/2}$;

$M^E = R^6R^7R^ESiO_{1/2}$;

$D = R^8R^9SiO_{2/2}$;

$D^H = R^{10}HSiO_{2/2}$;

$D^E = R^{11}R^ESiO_{2/2}$;

$T = R^{12}SiO_{3/2}$;

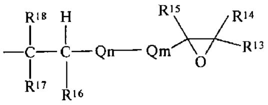
$T^H = HSiO_{3/2}$;

$T^E = R^ESiO_{3/2}$; and

$Q = SiO_{4/2}$;

where R^1, R^2, R^3, R^8, R^9 and R^{12} are independently monovalent hydrocarbon radicals having from one to sixty carbon atoms; R^4, R^5 and R^{10} are independently monovalent hydrocarbon radicals having from one to sixty carbon atoms or hydrogen; R^6, R^7, R^{11} are independently monovalent hydrocarbon radicals having from one to sixty carbon atoms or R^E; each R^E is independently a monovalent hydrocarbon radical containing one or more oxirane moieties having from one to sixty carbon atoms; the stoichiometric subscripts a, b, c, d, e, f, g, h, i, and j are either zero or positive subject to the following limitations: $a + b + c > 1$; $b + e + h > 1$; $c + f + i > 1$; $b + e + h > c + f + i$; and when $d + e + f + g + h + i + j = 0$, $a + b + c = 2$.

32. The composition of claim 31 where R^E has the formula:



where R^{13}, R^{14}, R^{15}, R^{16}, R^{17} and R^{18} are each independently selected from the group of hydrogen and monovalent hydrocarbon radicals having from one to sixty carbon atoms, Q_m is a di- or trivalent hydrocarbon radical having from one to sixty carbon atoms, Q_n is a divalent hydrocarbon radical having from one to sixty carbon atoms with the subscripts m and n independently zero or one subject to the limitation that when Qm is trivalent one of R^{13} or R^{14} is absent.

33. The composition of claim 31 where R^E is selected from the group consisting of 4-vinyl cyclohexene oxide, allyl glycidyl ether, limonene oxide, 1,2-epoxy-5-hexene, 1,2-epoxy-7-octene, norbornadiene monoepoxide and 1,2-epoxy-9-decene.

34. The composition of claim 32 where R^{13}, R^{14}, R^{15}, R^{16}, R^{17} and R^{18} are hydrogen and m and n are zero.

35. The composition of claim 33 where R^E is 4-vinyl cyclohexene oxide.

36. The composition of claim 31 where R^1, R^2, R^3, R^8, R^9 and R^{12} are independently selected from the group consisting of methyl, ethyl, sec-butyl, tert-butyl, octyl, decyl, dodecyl, cetyl, stearyl, ethenyl, propenyl, butynyl, hydroxypropyl, butoxy, 2,5,8-trioxadecanyl, carboxymethyl, chloromethyl, C30+ and 3,3,3-fluoropropyl.

37. The composition of claim 32 where R^1, R^2, R^3, R^8, R^9 and R^{12} are independently selected from the group consisting of methyl, ethyl, sec-butyl, tert-butyl, octyl, decyl, dodecyl, cetyl, stearyl, ethenyl, propenyl, butynyl, hydroxypropyl, cyanoethyl, butoxy, 2,5,8-trioxadecanyl, carboxymethyl, chloromethyl and 3,3,3-fluoropropyl.

38. The composition of claim 33 where R^1, R^2, R^3, R^8, R^9 and R^{12} are independently selected from the group consisting of methyl, ethyl, sec-butyl, tert-butyl, octyl, decyl, dodecyl, cetyl, stearyl, ethenyl, propenyl, butynyl, hydroxypropyl, cyanoethyl, butoxy, 2,5,8-trioxadecanyl, carboxymethyl, chloromethyl and 3,3,3-fluoropropyl.

39. The composition of claim 34 where R^1, R^2, R^3, R^8, R^9 and R^{12} are independently selected from the group consisting of methyl, ethyl, sec-butyl, tert-butyl, octyl, decyl, dodecyl, cetyl, stearyl, ethenyl, propenyl, butynyl, hydroxypropyl, cyanoethyl, butoxy, 2,5,8-trioxadecanyl, carboxymethyl, chloromethyl and 3,3,3-fluoropropyl.

40. The composition of claim 35 where R^1, R^2, R^3, R^8, R^9 and R^{12} are independently selected from the group consisting of methyl, ethyl, sec-butyl, tert-butyl, octyl, decyl, dodecyl, cetyl, stearyl, ethenyl, propenyl, butynyl, hydroxypropyl, cyanoethyl, butoxy, 2,5,8-trioxadecanyl, carboxymethyl, chloromethyl and 3,3,3-fluoropropyl.

41. A cosmetic composition comprising a non-aqueous emulsion where the continuous phase comprises a non-aqueous hydroxylic solvent and the discontinuous phase comprises a composition comprising the reaction product of:

$M_aM^H_bM^E_cD_dD^H_eD^E_f T_gT^H_hT^E_iQ_j$

where

$M = R^1R^2R^3SiO_{1/2}$;

$M^H = R^4R^5H\ SiO_{1/2}$;

$M^E = R^6R^7R^ESiO_{1/2}$;

$D = R^8R^9SiO_{2/2}$;

$D^H = R^{10}HSiO_{2/2}$;

$D^E = R^{11}R^ESiO_{2/2}$;

$T = R^{12}SiO_{3/2}$;

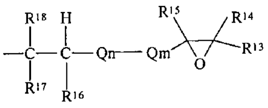
$T^H = HSiO_{3/2}$;

$T^E = R^ESiO_{3/2}$; and

$Q = SiO_{4/2}$;

where R^1, R^2, R^3, R^8, R^9 and R^{12} are independently monovalent hydrocarbon radicals having from one to sixty carbon atoms; R^4, R^5 and R^{10} are independently monovalent hydrocarbon radicals having from one to sixty carbon atoms or hydrogen; R^6, R^7 , R^{11} are independently monovalent hydrocarbon radicals having from one to sixty carbon atoms or R^E; each R^E is independently a monovalent hydrocarbon radical containing one or more oxirane moieties having from one to sixty carbon atoms; the stoichiometric subscripts a, b, c, d, e, f, g, h, i, and j are either zero or positive subject to the following limitations: $a + b + c > 1$; $b + e + h > 1$; $c + f + i > 1$; $b + e + h > c + f + i$; and when $d + e + f + g + h + i + j = 0$, $a + b + c = 2$.

42. The composition of claim 41 where R^E has the formula:



where R^{13}, R^{14}, R^{15}, R^{16}, R^{17} and R^{18} are each independently selected from the group of hydrogen and monovalent hydrocarbon radicals having from one to sixty carbon atoms, Q_m is a di- or trivalent hydrocarbon radical having from one to sixty carbon atoms, Q_n is a divalent hydrocarbon radical having from one to sixty carbon atoms with the subscripts m and n independently zero or one subject to the limitation that when Qm is trivalent one of R^{13} or R^{14} is absent.

43. The composition of claim 41 where R^E is selected from the group consisting of 4-vinyl cyclohexene oxide, allyl glycidyl ether, limonene oxide, 1,2-epoxy-5-hexene, 1,2-epoxy-7-octene, norbornadiene monoepoxide and 1,2-epoxy-9-decene.

44. The composition of claim 42 where R^{13}, R^{14}, R^{15}, R^{16}, R^{17} and R^{18} are hydrogen and m and n are zero.

45. The composition of claim 43 where R^E is 4-vinyl cyclohexene oxide.

46. The composition of claim 41 where R^1, R^2, R^3, R^8, R^9 and R^{12} are independently selected from the group consisting of methyl, ethyl, sec-butyl, tert-butyl, octyl, decyl, dodecyl, cetyl, stearyl, ethenyl, propenyl, butynyl, hydroxypropyl, butoxy, 2,5,8-trioxadecanyl, carboxymethyl, chloromethyl, C30+ and 3,3,3-fluoropropyl.

47. The composition of claim 42 where R^1, R^2, R^3, R^8, R^9 and R^{12} are independently selected from the group consisting of methyl, ethyl, sec-butyl, tert-butyl, octyl, decyl, dodecyl, cetyl, stearyl, ethenyl, propenyl, butynyl, hydroxypropyl, cyanoethyl, butoxy, 2,5,8-trioxadecanyl, carboxymethyl, chloromethyl and 3,3,3-fluoropropyl.

48. The composition of claim 43 where R^1, R^2, R^3, R^8, R^9 and R^{12} are independently selected from the group consisting of methyl, ethyl, sec-butyl, tert-butyl, octyl, decyl, dodecyl, cetyl, stearyl, ethenyl, propenyl, butynyl, hydroxypropyl, cyanoethyl, butoxy, 2,5,8-trioxadecanyl, carboxymethyl, chloromethyl and 3,3,3-fluoropropyl.

49. The composition of claim 44 where R^1, R^2, R^3, R^8, R^9 and R^{12} are independently selected from the group consisting of methyl, ethyl, sec-butyl, tert-butyl, octyl, decyl, dodecyl, cetyl, stearyl, ethenyl, propenyl, butynyl, hydroxypropyl, cyanoethyl, butoxy, 2,5,8-trioxadecanyl, carboxymethyl, chloromethyl and 3,3,3-fluoropropyl.

50. The composition of claim 45 where R^1, R^2, R^3, R^8, R^9 and R^{12} are independently selected from the group consisting of methyl, ethyl, sec-butyl, tert-butyl, octyl, decyl, dodecyl, cetyl, stearyl, ethenyl, propenyl, butynyl, hydroxypropyl, cyanoethyl, butoxy, 2,5,8-trioxadecanyl, carboxymethyl, chloromethyl and 3,3,3-fluoropropyl.

51. The cosmetic composition of claim 1 wherein the cosmetic composition is selected from the group consisting of deodorants, antiperspirants, combination antiperspirant deodorants, shaving products, skin lotions, moisturizers, toners, bath products, cleansing products, hair care products, shampoos, conditioners, mousses, styling gels, hair sprays, hair dyes, hair coloring products, hair bleaches, hair waving products, hair straighteners, manicure products nail polish, nail polish remover, nail creams, nail lotions, cuticle softeners, protective creams, sunscreen, insect repellent, anti-aging products, color cosmetics, lipsticks, foundations, face powders, eye liners, eye shadows, blushes, makeup, mascaras, personal care formulations where silicone components have been conventionally added, and drug delivery systems for topical application of medicinal compositions that are to be applied to the skin.

52. The cosmetic composition of claim 11 wherein the cosmetic composition is selected from the group consisting of deodorants, antiperspirants, combination antiperspirant deodorants, shaving products, skin lotions, moisturizers, toners, bath products, cleansing products, hair care products, shampoos, conditioners, mousses, styling gels, hair sprays, hair dyes, hair coloring products, hair bleaches, hair waving products, hair straighteners, manicure products nail polish, nail polish remover, nail creams, nail lotions, cuticle softeners, protective creams, sunscreen, insect repellent, anti-aging products, color cosmetics, lipsticks, foundations, face powders, eye liners, eye shadows, blushes, makeup, mascaras, personal care formulations where silicone components have been conventionally added, and drug delivery systems for topical application of medicinal compositions that are to be applied to the skin.

53. The cosmetic composition of claim 21 wherein the cosmetic composition is selected from the group consisting of deodorants, antiperspirants, combination antiperspirant deodorants, shaving products, skin lotions, moisturizers, toners, bath products, cleansing products, hair care products, shampoos, conditioners, mousses, styling gels, hair sprays, hair dyes, hair coloring products, hair bleaches, hair waving products, hair straighteners, manicure products nail polish, nail polish remover, nail creams, nail lotions, cuticle softeners, protective creams, sunscreen, insect repellent, anti-aging products, color cosmetics, lipsticks, foundations, face powders, eye liners, eye shadows, blushes, makeup, mascaras, personal care formulations where silicone components have been conventionally added, and drug delivery systems for topical application of medicinal compositions that are to be applied to the skin.

54. The cosmetic composition of claim 31 wherein the cosmetic composition is selected from the group consisting of deodorants, antiperspirants, combination antiperspirant deodorants, shaving products, skin lotions, moisturizers, toners, bath products, cleansing products, hair care products, shampoos, conditioners, mousses, styling gels, hair sprays, hair dyes, hair coloring products, hair bleaches, hair waving products, hair straighteners, manicure products nail polish, nail polish remover, nail creams, nail lotions, cuticle softeners, protective creams, sunscreen, insect repellent, anti-aging products, color cosmetics, lipsticks, foundations, face powders, eye liners, eye shadows, blushes, makeup, mascaras, personal care formulations where silicone components have been conventionally added, and drug delivery systems for topical application of medicinal compositions that are to be applied to the skin.

55. The cosmetic composition of claim 41 wherein the cosmetic composition is selected from the group consisting of deodorants, antiperspirants, combination antiperspirant deodorants, shaving products, skin lotions, moisturizers, toners, bath products, cleansing products, hair care products, shampoos, conditioners, mousses, styling gels, hair sprays, hair dyes, hair coloring products, hair bleaches, hair waving products, hair straighteners, manicure products nail polish, nail polish remover, nail creams, nail lotions, cuticle softeners, protective creams, sunscreen, insect repellent, anti-aging products, color cosmetics, lipsticks, foundations, face powders, eye liners, eye shadows, blushes, makeup, mascaras, personal care formulations where silicone components have been conventionally added, and drug delivery systems for topical application of medicinal compositions that are to be applied to the skin.

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(54) Title: COSMETIC COMPOSITIONS USING POLYETHER SILOXANE COPOLYMER NETWORK COMPOSITIONS

(57) Abstract: A composition comprising the reaction products of $M_aM^H_bM^E_cD_dD^H_eD^E_fT_gT^H_hT^E_iQ_j$ where $M=R^1R^2R^3SiO_{1/2}$; M^H=R4R^5H $SiO_{1/2}$; $M^E=R^6R^7R^ESiO_{1/2}$; $D=R^8R^9SiO_{2/2}$; $D^H=R^{10}HsiO_{2/2}$; $D^E=R^{11}R^ESiO_{2/2}$; $T=R^{12}SiO_{3/2}$; $T^H=HsiO_{3/2}$; TE=$R^ESiO_{3/2}$; and $Q=SiO_{4/2}$; where the stoichiometric subscripts a, b, c, d, e, f, g, h, i, and j are either zero or positive. In a preferred embodiment the reaction product of the present invention is a polyether siloxane copolymer network. In another preferred embodiment the reaction product of the present invention is a polyether siloxane copolymer network swollen with a volatile low molecular weight silicon containing compound.

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(54) Title: COSMETIC COMPOSITIONS USING POLYETHER SILOXANE COPOLYMER NETWORK COMPOSITIONS

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COSMETIC COMPOSITIONS USING POLYETHER SILOXANE COPOLYMER NETWORK COMPOSITIONS

FIELD OF THE INVENTION

The present invention relates to silicone compositions, more particularly to compositions comprising a silicone polymer network comprising cross-links derived from epoxide or oxirane moieites.

BACKGROUND OF THE INVENTION

The personal care industry thrives on being able to deliver multiple performance products based on mixtures of several components, with each having performance characteristics important to or desirable in the final formulation. One desirable characteristic is the ability to provide a silky initial feel derived from low molecular weight silicones, such as for example, octamethylcyclotetrasilioxane or decamethylcyclopentasiloxane, in the formulation while maintaining a high, but shear-thinnable viscosity. While these low molecular weight silicones provide the desired feel characteristics, they are also low viscosity, highly flowable liquids. Thus they are not easily held in a formulation, preferring rather to separate and flow out of a given container or flow uncontrollably across the skin when used in a specific application. Further, it desirable to achieve an initial silky feel while providing a smooth, low-residue feel upon dry-down. Polymeric silicone gels prepared in volatile silicone have been found to deliver desirable initial feel of volatile, low viscosity silicones to formulations while at the same time provide high viscosity and a smooth silky feel on dry-down, see for example, US Patent Nos.5,760,116, 5,493,041 and 4,987,169.

Such polymeric silicone gels have typically been made by the hydrosilylation reaction, which requires the use of both SiH functional groups and terminal olefinic groups to form crosslinked siloxane polymers. Thus only siloxane structures that can incorporate silylhydride groups and optionally, vinyl functional siloxane groups, can be utilized in making these materials. Further this method of generating crosslinked siloxane polymers limits the range of desirable organofunctional groups that may be incorporated into the polymeric structure to create additional performance advantages in complex formulations. Thus attempts to include organofunctional groups into the crosslinked siloxane polymer include unsaturated organic groups compatible with the hydrosilylaton reaction.

SUMMARY OF THE INVENTION

A cosmetic composition comprising the reaction products of

$M_aM^H_bM^E_cD_dD^H_eD^E_f T_gT^H_hT^E_iQ_j$

where

$M = R^1R^2R^3SiO_{1/2}$;

$M^H = R^4R^5H\ SiO_{1/2}$;

$M^E = R^6R^7R^ESiO_{1/2}$;

$D = R^8R^9SiO_{2/2}$;

$D^H = R^{10}HSiO_{2/2}$;

$D^E = R^{11}R^ESiO_{2/2}$;

$T = R^{12}SiO_{3/2}$;

$T^H = HSiO_{3/2}$;

$T^E = R^ESiO_{3/2}$; and

$Q = SiO_{4/2}$;

where R^1, R^2, R^3, R^8, R^9 and R^{12} are independently monovalent hydrocarbon radicals having from one to sixty carbon atoms; R^4, R^5 and R^{10} are independently monovalent hydrocarbon radicals having from one to sixty carbon atoms or hydrogen; R^6, R^7 , R^{11} are independently monovalent hydrocarbon radicals having from one to sixty carbon atoms or R^E; each R^E is independently a monovalent hydrocarbon radical containing one or more oxirane moieties having from one to sixty carbon atoms; the stoichiometric subscripts a, b, c, d, e, f, g, h, i, and j are either zero or positive subject to the following limitations: $a + b + c > 1$; $b + e + h > 1$; $c + f + i > 1$; $b + e + h > c + f + i$; and when $d + e + f + g + h + i + j = 0$, $a + b + c = 2$. In a preferred embodiment the reaction product of the present invention is a polyether siloxane copolymer network. In another preferred embodiment the reaction product of the present invention is a polyether siloxane copolymer network swollen with a volatile low molecular weight silicon containing compound. These compositions are useful for a variety of personal care compositions.

DETAILED DESCRIPTION OF THE INVENTION

The compositions of the present invention comprise the reaction products of an epoxy functional hydrido siloxane molecule having the following formula:

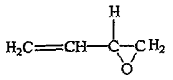
$M_aM^H_bM^E_cD_dD^H_eD^E_f T_gT^H_hT^E_iQ_j$
where
$M = R^1R^2R^3SiO_{1/2}$;
$M^H = R^4R^5H\ SiO_{1/2}$;
$M^E = R^6R^7R^ESiO_{1/2}$;
$D = R^8R^9SiO_{2/2}$;
$D^H = R^{10}HSiO_{2/2}$;
$D^E = R^{11}R^ESiO_{2/2}$;
$T = R^{12}SiO_{3/2}$;
$T^H = HSiO_{3/2}$;
$T^E = R^ESiO_{3/2}$; and
$Q = SiO_{4/2}$;

where R^1, R^2, R^3, R^8, R^9 and R^{12} are independently monovalent hydrocarbon radicals having from one to sixty carbon atoms; R^4, R^5 and R^{10} are independently monovalent hydrocarbon radicals having from one to sixty carbon atoms or hydrogen; R^6, R^7 , R^{11} are independently monovalent hydrocarbon radicals having from one to sixty carbon atoms or R^E; each R^E is independently a monovalent hydrocarbon radical containing one or more oxirane moieties having from one to sixty carbon atoms; the stoichiometric subscripts a, b, c, d, e, f, g, h, i, and j are either zero or positive subject to the following limitations: $a + b + c > 1$; $b + e + h > 1$; $c + f + i > 1$; $b + e + h > c + f + i$; and when $d + e + f + g + h + i + j = 0$, $a + b + c = 2$.

One method of producing the composition of the present invention is to react a molecule having the following formula:

$M_aM^H_{b'}D_dD^H_{e'}T_gT^H_{h'}Q_j$

wherein the definitions and relationships are as later defined (and also consistent with those defined above) under hydrosilylation conditions with an olefinically unsaturated molecule containing one or more oxirane moieties under conditions of stoichiometry where the molar quantity of oxirane is less than the molar quantity of silyl hydride. As used herein the phrase "an olefinically unsaturated molecule containing one or more oxirane moieties" means a molecule possessing one or more interior, pendant or terminal carbon carbon double bonds simultaneously with one or more interior, pendant or terminal three membered oxygen containing heterocyclic rings (chemically the phrase "three membered oxygen containing heterocyclic ring" is used herein interchangeably with the oxirane or epoxide structures). The simplest chemical structure exemplified by such a definition is:



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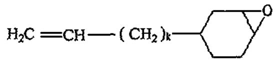
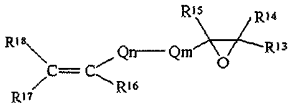
but also includes alicyclic structures exemplified by:



Where the subscript k may be zero or a positive integer, more preferably a positive integer ranging generally from 0 to about 10. It should be noted that both exemplified structures are terminal in both the olefinic moiety and the oxirane (epoxide) moiety. A more general chemical structure is:



where R^{13}, R^{14}, R^{15}, R^{16}, R^{17} and R^{18} are each independently selected from the group of hydrogen and monovalent hydrocarbon radicals having from one to sixty carbon atoms, Q_m is a di- or trivalent hydrocarbon radical having from one to sixty carbon atoms, Q_n is a divalent hydrocarbon radical having from one to sixty carbon atoms with the subscripts m and n independently zero or one subject to the limitation that when Qm is trivalent one of R^{13} or R^{14} is absent and where R^{16} and R^{18} may be either cis- or trans- to each other.

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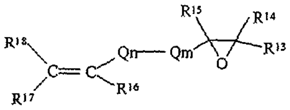
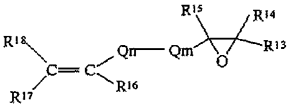
Thus one possible synthetic pathway to prepare the reaction products of the present invention is as follows:

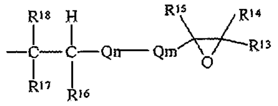


$M_aM^H_{b'}D_dD^H_{e'}T_gT^H_{h'}Q_j$ + α reacting under hydrosilylation conditions to yield $M_aM^H_bM^E_cD_dD^H_eD^E_fT_gT^H_hT^E_iQ_j$ when the stoichiometric coefficient, α, is less than the sum of b' + e' + h'. It should be noted that the stoichiometric coefficients b, e, and h define the quantity of hydride bearing species M^H, D^H and T^H in both reactant and product and are related one to other in that fashion but because some of the hydride bearing functions have reacted with an olefinically unsaturated molecule containing one or more oxirane moieties the following relationships must necessarily obtain: b' + e' + h' > b + e + h and b + c + e + f + h + i = b' + e' + h'. It is to be noted that acetylene analogs of the olefinically unsaturated oxirane containing molecules will produce similar species that will react to form similar products. Thus as used herein the phrase an olefinically unsaturated molecule containing one or more oxirane moieties is intended to also include an acetylenically unsaturated molecule containing one or more oxirane moieties. The phrase "an acetylenically unsaturated molecule containing one or more oxirane moieties" means a molecule possessing one or more interior, pendant or terminal carbon carbon triple bonds simultaneously with one or more interior, pendant or terminal

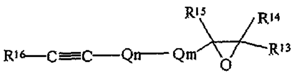


three membered oxygen containing heterocyclic rings (chemically the phrase "three membered oxygen containing heterocyclic ring" is used herein interchangeably with the oxirane or epoxide structures). When the epoxide compound is an olefinic epoxide, a specific example being:

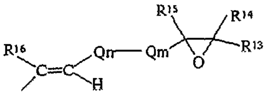
then R^E as a substituent, becomes



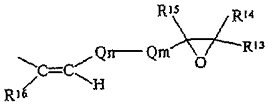
with all the definitions consistent with those as previously defined. When the epoxide is an acetylenic epoxide, a specific example being:



then R^E as a substituent, becomes either:



or



with all the definitions consistent with those as previously defined.

The silyl hydride bearing precursor molecule, $M_aM^H_{b'}D_dD^H_{e'}T_gT^H_{h'}Q_j$, can be prepared by a variety of techniques known in the art. Epoxy substituted siloxanes are prepared in the normal manner through the use of a hydrosilylation reaction to attach a vinyl or allyl substituted epoxide onto an SiH bearing siloxane. SiH containing siloxanes are well known in the art and can be linear, branched, or cyclic in structure. Examples of useful vinyl or allyl substituted epoxides include 4-vinyl cyclohexene oxide, allyl glycidyl ether, limonene oxide, 1,2-epoxy-5-hexene, 1,2-epoxy-7-octene, norbornadiene monoepoxide and 1,2-epoxy-9-decene. Precious metal catalysts suitable for making epoxy siloxanes are also well known in the art and comprise complexes of rhodium, ruthenium, palladium, osmium, iridium and /or platinum.

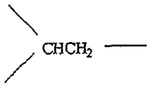
Many types of platinum catalysts for this SiH olefin addition reaction (hydrosilation or hydrosilylation) are known and such platinum catalysts may be used for the reaction in the present instance. When optical clarity is required the preferred platinum catalysts are those platinum compound catalysts that are soluble in the reaction mixture. The platinum compound can be selected from those having the formula ($PtCl_2$Olefin) and H($PtCl_3$Olefin) as described in U.S. patent number 3,159,601, hereby incorporated by reference. A further platinum containing material usable in the compositions of the present invention is the cyclopropane complex of platinum chloride described in U.S. patent number 3,159,662 hereby incorporated by reference. Further the platinum containing material can be a complex formed from chloroplatinic acid with up to 2 moles per gram of platinum of a member selected from the class consisting of alcohols, ethers, aldehydes and mixtures of the above as described in U.S. patent number 3,220,972 hereby incorporated by reference. The catalysts preferred for use are described in U. S. Patents numbers 3,715,334; 3,775,452; and 3,814,730 to Karstedt. Additional background concerning the art may be found at J. L. Spier, "Homogeneous Catalysis of Hydrosilation by Transition Metals, in Advances in Organometallic Chemistry, volume 17, pages 407 through 447, F.G.A. Stone and R. West editors, published by the Academic Press (New York, 1979). Persons skilled in the art can easily determine an effective amount of platinum catalyst. Generally, an effective amount ranges from about 0.1 to 50 parts per million of the total organopolysiloxane composition.

The reaction product of $M_aM^H_bM^E_cD_dD^H_eD^E_fT_gT^H_hT^E_iQ_j$ produces a polymer network, believed to be a polyether siloxane copolymer network (or alternativeley a siloxane polyether copolymer network). As used herein, the terminology "network" means a three dimensionally extending structure comprising interconnected polyether siloxane copolymer chains. Preferably, fluid is contained within interstices of the network. The term "interstices" is used herein in reference to a network to denote spaces within the network, that is, spaces between the polyether siloxane copolymer chains of the network. As used herein in the context of the polyether siloxane copolymer network, the term polyether is intended to include the reaction product of two or more epoxide moieties to form one or more ether linkages that form a cross link between siloxane chains or moieties.

In one preferred embodiment, the polyether siloxane copolymer network is a crosslinked network that is insoluble in the fluid component of the silicone composition of the present invention, but that is capable of being swollen by the fluid. The amount of crosslinking present in the crosslinked network may be characterized with respect to the degree of swelling exhibited by the network in the fluid. In another preferred embodiment, the crosslinked structure of the network is effective to allow the network to be swollen by a low molecular weight silicone fluid, such as, for example, decamethylcyclopentasiloxane, from its original volume to a swollen volume that is a factor of from 1.01 to 5000, more preferably from 2 to 1000, and even more preferably from 5 to 500, times its original volume. The original volume of the network can be determined, for example, by extracting or evaporating all of the fluid component from the silicone composition of the present invention to leave the original volume, that is, the volume of the polyether siloxane copolymer network in the absence of the fluid.

As used herein the terminology "hydrocarbon radical" includes acyclic hydrocarbon radicals, alicyclic hydrocarbon radicals and aromatic hydrocarbon radicals.

As used herein in reference to a hydrocarbon radical, the term "monovalent" means that the radical is capable of forming one covalent bond per radical, the term "divalent" means that the radical is capable of forming two covalent bonds per radical and the term "trivalent" means that the radical is capable of forming three covalent bonds per radical. Generally, a monovalent radical can be represented as having been derived from a saturated hydrocarbon compound by conceptual removal of one hydrogen atom from the compound, a divalent radical can be represented as having been derived from a saturated hydrocarbon compound by conceptual removal of two hydrogen atoms from the compound and a trivalent radical can be represented as having been derived from a saturated hydrocarbon compound by conceptual removal of three hydrogen atoms from the compound. For example, an ethyl radical, that is, a $-CH_2CH_3$ radical, is a monovalent radical; a dimethylene radical, that is, a $-(CH_2)_2-$ radical, is a divalent radical and an ethanetriyl radical, that is,



radical, is a trivalent radical, each of which can be represented as having been derived by conceptual removal of one or more hydrogen atoms from the saturated hydrocarbon ethane.

As used herein, the terminology "acyclic hydrocarbon radical" means a straight chain or branched hydrocarbon radical, preferably containing from 1 to 60 carbon atoms per radical, which may be saturated or unsaturated and which may be optionally substituted or interrupted with one or more atoms or functional groups, such as, for example, carboxyl, cyano, hydroxy, halo and oxy. As long as these functional groups do not interfere with the cationic cure mechanism of the epoxide or oxirane moiety, suitable monovalent acyclic hydrocarbon radicals may include, for example, alkyl, alkenyl, alkynyl, hydroxyalkyl, cyanoalkyl, carboxyalkyl, alkyloxy, oxaalkyl, alkylcarbonyloxaalkylene, carboxamide and haloalkyl, such as, for example, methyl, ethyl, sec-butyl, tert-butyl, octyl, decyl, dodecyl, cetyl, stearyl, ethenyl, propenyl, butynyl, hydroxypropyl, cyanoethyl, butoxy, 2,5,8-trioxadecanyl, carboxymethyl, chloromethyl and 3,3,3-fluoropropyl. Suitable divalent acyclic hydrocarbon radicals include, for example, linear or branched alkylene radicals, such as, for example, methylene, dimethylene, trimethylene, decamethylene, ethylethylene, 2-methyltrimethylene, 2,2-dimethyltrimethylene and linear or branched oxalkylene radicals such as, for example, methyleneoxypropylene. Suitable trivalent acyclic hydrocarbon radicals include, for example, alkanetriyl radicals, such as, for example, 1,1,2-

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ethanetriyl, 1,2,4-butanetriyl, 1,2,8-octanetriyl, 1,2,4-cyclohexanetriyl and oxaalkanetriyl radicals such as, for example, 1,2,6-triyl-4-oxahexane.

As used herein the term "alkyl" means a saturated straight or branched monovalent hydrocarbon radical. In a preferred embodiment, monovalent alkyl groups are selected from linear or branched alkyl groups containing from 1 to 60 carbons per group, such as, for example, methyl, ethyl, propyl, iso-propyl, n-butyl, iso-butyl, sec-butyl, tert-butyl, pentyl, hexyl, heptyl, decyl, dodecyl.

As used herein the term "alkenyl" means a straight or branched monovalent terminally unsaturated hydrocarbon radical, preferably containing from 2 to 10 carbon atoms per radical, such as, for example, ethenyl, 2-propenyl, 3-butenyl, 5-hexenyl, 7-octenyl and ethenylphenyl.

As used herein, the terminology "alicyclic hydrocarbon radical" means a radical containing one or more saturated hydrocarbon rings, preferably containing from 4 to 12 carbon atoms per ring, per radical which may optionally be substituted on one or more of the rings with one or more alkyl radicals, each preferably containing from 2 to 6 carbon atoms per alkyl radical, halo radicals or other functional groups and which, in the case of a monovalent alicyclic hydrocarbon radical containing two or more rings, may be fused rings. Suitable monovalent alicyclic hydrocarbon radicals include, for example, cyclohexyl and cyclooctyl. Suitable divalent hydrocarbon radicals include, saturated or unsaturated divalent monocyclic hydrocarbon radicals, such as, for example, 1,4-cyclohexylene. Suitable trivalent alicyclic hydrocarbon radicals include, for example, cycloalkanetriyl radicals such as, for example, 1-dimethylene-2, 4-cyclohexylene, 1-methylethylene-3-methyl-3,4-cyclohexylene.

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As used herein, the terminology "aromatic hydrocarbon radical" means a hydrocarbon radical containing one or more aromatic rings per radical, which may, optionally, be substituted on the aromatic rings with one or more alkyl radicals, each preferably containing from 2 to 6 carbon atoms per alkyl radical, halo radicals or other functional groups and which, in the case of a monovalent aromatic hydrocarbon radical containing two or more rings, may be fused rings. Suitable monovalent aromatic hydrocarbon radicals include, for example, phenyl, tolyl, 2,4,6-trimethylphenyl, 1,2-isopropylmethylphenyl, 1-pentalenyl, naphthyl, anthryl, eugenol and allylphenol as well as aralkyl radicals such as, for example, 2-phenylethyl. Suitable divalent aromatic hydrocarbon radicals include, for example, divalent monocyclic arenes such as, for example, 1,2-phenylene, 1,4-phenylene, 4-methyl-1,2-phenylene, phenylmethylene. Suitable trivalent aromatic hydrocarbon radicals include, for example, trivalent monocyclic arenes such as, for example, 1-trimethylene-3,5-phenylene.

In a preferred embodiment, the epoxy functional organosiloxane compound is reacted by polymerizing the epoxy functional organosiloxane compound under cationic polymerization conditions and, preferably, in the presence of a fluid, preferably a volatile siloxane fluid. In one embodiment, the epoxy functional organosiloxane compound is polymerized in the presence of a fluid to directly form the silicone composition of the present invention. In another embodiment, the epoxy functional organosiloxane compound is polymerized in the presence of a first fluid or fluid mixture to form a polyether siloxane copolymer network, and then the network so formed is subsequently swollen with a second fluid or fluid mixture to form the silicone composition of the present invention. The second fluid or fluid mixture may be the same as or different from the first fluid mixture. The first solvent may, optionally, be removed from the polymerized network by, for

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example, evaporation, prior to addition of the second fluid. As a further alternative, the epoxy functional organosiloxane compound is polymerized in the absence of a fluid to form a polyether siloxane copolymer network and the network is subsequently swollen with a fluid or mixture of fluids to form the silicone composition of the present invention. In another embodiment, the polymerization of the epoxy functional organosiloxane is conducted with a sufficient amount of excess hydridosiloxane functionality such that there is residual hydride remaining after polymerization that may be subsequently reacted under conditions suitable for hydrosilylation with one or more alkenyl functional compounds. This is especially advantageous in cases where the alkenyl functional compounds can act as inhibitors of cationic cure. Such alkenyl compounds are those that contain a functionality that can act as an inhibitor of the cationic cure mechanism, e.g. a base. In another embodiment, a small amount of a concentrated hydridosiloxane or hydridosilane compound is added in order to increase the rate of polymerization.

Cationic polymerization conditions can be generated by addition of an acid catalyst capable of polymerizing an epoxy group such as, for example, by addition of onium salt generated acids and certain metal salts, such as, for example, aluminum trichloride and ferric chloride, which act as Lewis acids or by addition of lanthanide triflates, see PCT Int. Appl. WO 0008,087. Acid catalyzed polymerization of epoxides is a well known method of forming organic polymers and has been applied to epoxy-functional siloxane compounds in order to form siloxane polyalkyleneoxide block copolymers for use in a variety of applications as, for example, release coatings on paper, see, for example, U.S. Patent No.4,279,717, and in conjunction with organic materials to form coatings and modified plastic compositions, see for example, U.S. Patent Nos. 5,354,796 and 5,663,752. One precautionary note must be observed, that is if the cationic polymerization is conducted in the presence of cyclic siloxanes, e.g. D_3, D_4 or D_5 and the like, the strength of the acid catalysis employed must be such that cationic polymerization of the epoxide moiety occurs but polymerization of the cyclic siloxane does not occur to any appreciable extent.

In a preferred embodiment, the epoxy functional organosiloxane compound is polymerized under cationic cure conditions generated through the interaction with platinum and an SiH-containing compound. This epoxide polymerization reaction route is described in U.S. Patent No. 5,128,431 and by J.V. Crivello and N. Fan, J. Polymer Sci., Part A: Polymer Chemistry, pp.1853-1863 (1997). In this embodiment, the reaction kinetics appear to be dependent upon the presence of trace quantities of molecular oxygen.

The polyether siloxane copolymer network compositions of the present invention produce a cross linked structure that possesses a certain amount of steric hindrance by reason of the cross links. This steric hindrance tends to prevent the reaction from going to completion even at long reaction times and thus a certain amount of residual functionality may remain. This residual functionality provides the ability to incorporate other functionality into the polyether siloxane copolymer network by reaction with functionalized molecules that are not as sterically constrained as the polyether siloxane copolymer network or it must be chemically inactivated. One reason the residual functionality might desirably be chemically inactivated is that in the processing of these materials as a polyether siloxane copolymer network swollen with a low molecular weight siloxane compound (or alternatively, low molecular weight silicone fluid), usually D_3, D_4, D_5, D_6 or $M'D'_qT'_sM'$ as later defined, is that processing under conditions of high shear tends to disrupt the network reducing the level of steric hindrance and thus could

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enable further cross linking reactions to occur because of the chemically exposed residual functionality. Post-cure cross linking is known to occur in addition polymerized silicones where the addition polymerization occurs via hydrosilylation. These materials are prepared by first hydrosilylation of a silyl hydride with an olefinic or acetylenic oxirane or epoxide compound. Thus a noble metal hydrosilylation catalyst will be present in the reaction mixture or within the interstices of the polyether siloxane copolymer network. This catalyst may be used to further polymerize the oxirane or epoxide moiety (moieties) incorporated in the reaction product producing the polyether siloxane copolymer network(s) of the present invention. The residual functionality remaining by design, i.e. by use of sub-stoichiometric quantities, or by reason of steric inhibition of reaction completion may be further reacted as taught herein or neutralized or inhibited. US patents 5,977,280 and 5,929,164, both herein incorporated by reference, teach such neutralization of hydrosilylation catalysts by treatment with strong noble metal complexing ligands, for example phosphines, amines and organic sulfur compounds such as organic sulfides and thiols. However, some of these strongly complexing ligands, while deactivating a noble metal hydrosilylation catalyst are toxic and thus their use must be avoided in some applications, e.g. personal care applications. Thus sulfur containing amino acid esters are strong noble metal complexing ligands and methionine methyl ester, methionine ethyl ester, cysteine methyl ester, cysteine ethyl ester and cysteine dimethyl ester have been preferred for such noble metal deactivation. It should be noted that naturally occuring proteins containing disulfide linkages that are easily disrupted may also be used to deactivate the noble metal catalysts employed, e.g. egg yolks and the like. Sulfur containing amino acid amides, polypeptides and the like may also function similarly to deactivate noble metal hydrosilylation catalysts.

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The method of polymer synthesis provides for incorporation of a wide range of organofunctional groups into the copolymeric structure. Thus, the inclusion of other organofunctional groups, such as, for example, organic epoxides, epoxysiloxanes, terminally unsaturated organic and alkenylsiloxane compounds can be used to modify the resulting copolymers.

In an alternative embodiment, the organofunctional groups are introduced to the network during polymerization of the epoxyfunctional organosiloxane by including organofunctional compounds to the reaction mixture which are copolymerizable with the epoxy functional organosiloxane under the chosen polymerization reaction conditions.

In one embodiment, polymerization of the epoxy functional organosiloxane is conducted in the presence of one or more organic epoxide compounds which are copolymerizable with epoxy functional hydrido siloxanes under the polymerization conditions to form mixed polyalkyleneoxide units. The additional organic epoxide compounds may contain different substituents to further modify the resulting copolymer. Suitable organic epoxide compounds include, for example, ethylene oxide, propylene oxide, butylene oxide, cyclohexene oxide, glycidol and epoxide oils suchas for example epoxidized soybean oil.

In another embodiment, the polymerization of the epoxy functional organosiloxane is conducted in the presence of one or more hydroxyl functional compounds which are copolymerizable with epoxy functional hydrido siloxanes under the polymerization conditions to modify the product copolymer. Suitable hydroxyl functional compounds include, for example, water, hydroxy-stopped polyethers, organic alcohols, including organic diols, carbinol functional siloxanes and hydroxy functional organopolysiloxane polymers, including polyethersiloxane copolymers.

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In another embodiment, the polymerization of the epoxy functional organosiloxane is conducted in the presence one or more alkenyl functional compounds which are copolymerizable with epoxy functional hydrido siloxanes under the polymerization conditions to modify the product copolymer. Suitable alkenyl functional compounds include alkenyl functional organic compounds, such as, for example, hexadiene, and alkenyl functional silicone compounds, such as for example, vinyl polydimethylsiloxanes. For example, an alkenyl-functional compound may conveniently be added via hydrosilylation in those embodiments in which the cationic reaction conditions for reacting the epoxide groups are generated using platinum and a hydrido-substituted siloxane, as described above.

The silicone composition may be further processed under low to high shear to adjust the viscosity and sensory feel of the composition. This may be achieved, for example, by subjecting the composition to a moderate to high shearing force. High shear may be applied using, for example, a Sonolator apparatus, a Gaulin Homogenizer or a Micro Fluidizer apparatus. Optionally, one or more fluids may be added to the silicone composition prior to the shearing.

In a preferred embodiment, the silicone composition of the present invention is a solid, typically having a creamy consistency, wherein the copolymer network acts as a means for gelling the fluid to reversibly impart characteristics of a solid to the fluid. At rest, the silicone composition exhibits the properties of a solid gel material. The silicone composition of the present invention exhibits high stability and resistance to syneresis, that is, the composition exhibits little or no tendency for fluid to flow from the composition and imparts high stability and syneresis resistance to personal care compositions which include the silicone composition as a component. The high stability and syneresis resistance persists with prolonged aging of

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such silicone compositions and personal care compositions. However, fluid may be released from the network by subjecting the silicone composition to a shearing force, such as, for example, by rubbing the composition between one's fingers, to provide improved sensory feel characteristic of the fluid component of the silicone material.

Fluids suitable for use as the fluid component of the composition of the present invention are those compounds or mixtures of two or more compounds that are in the liquid state at or near room temperature, for example, from about 20°C about 50°C, and about one atmosphere pressure, and include, for example, silicone fluids, hydrocarbon fluids, esters, alcohols, fatty alcohols, glycols and organic oils. In a preferred embodiment, the fluid component of the composition of the present invention exhibits a viscosity of below about 1,000 cSt, preferably below about 500 cSt, more preferably below about 250 cSt, and most preferably below 100 cSt, at 25 °C.

In a preferred embodiment, the fluid component of the present invention comprises an emollient compound. Suitable emollient compound include any fluid that provides emollient properties, that is, that when applied to skin, tend to remain on the surface of the skin or in the stratum corneum layer of the skin to act as lubricants, reduce flaking and to improve the appearance of the skin. Emollient compound are generically known and include, for example, hydrocarbons, such as for example, isododecane, isohexadecane and hydrogenated polyisobutene, organic waxes, such as for example, jojoba, silicone fluids, such as, for example, cyclopentasiloxane, dimethicone and bis-phenylpropyl dimethicone, esters, such as, for example, octyldodecyl neopentanoate and oleyl oleate, as well as fatty acids and alcohols, such as for example, oleyl alcohol and isomyristyl alcohol.

In a highly preferred embodiment, the fluid component of the present invention comprises a silicone fluid, more preferably a silicone fluid that exhibits emollient properties, preferably a low molecular weight silicone fluid or alternatively a low molecular weight siloxane compound. Suitable silicone fluids include, for example, cyclic silicones of the formula D_r, wherein D, R^8 and R^9 are as previously defined, preferably with R^8 and R^9 chosen from the group consisting of monovalent one to six carbon atom monovalent hydrocarbon radicals, more preferably methyl, and r is an integer wherein $3 \leq r \leq 12$, such as, for example, hexamethylcyclotrisiloxane ("D_3"), octamethylcyclotetrasiloxane ("D_4"), decamethylcyclopentasiloxane ("D_5"), and dodecamethylcyclohexasiloxane ("D_6") as well as linear or branched organopolysiloxanes having the formula:

$M'D'_qT'_sM'$

wherein:

M' is $R^{19}{}_3SiO_{1/2}$;

D' is $R^{20}{}_2SiO_{2/2}$;

T' is $R^{21}SiO_{3/2}$

R^{19}, R^{20} and R^{21} are each independently alkyl, aryl or aralkyl containing from one to sixty carbon atoms;

q and s are each independently integers from 0 to 300, preferably from 0 to 100, more preferably from 0 to 50, and most preferably from 0 to 20.

In a preferred embodiment, the silicone composition of the present invention comprises, per 100 parts by weight ("pbw") of the silicone composition, from 0.1 to 99 pbw, more preferably from 0.5 pbw to 30 pbw and still more preferably from 1 to 15 pbw of the polyether siloxane copolymer

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network and from 1 pbw to 99.9 pbw, more preferably from 70 pbw to 99.5 pbw, and still more preferably from 85 pbw to 99 pbw of the fluid.

The polyether siloxane copolymer network compositions of the present invention may be utilized as prepared or as the silicone component in emulsions. As is generally known, emulsions comprise at least two immiscible phases one of which is continuous and the other which is discontinuous. Further emulsions may be liquids with varying viscosities or solids. Additionally the particle size of the emulsions may be render them microemulsions and when sufficiently small microemulsions may be transparent. Further it is also possible to prepare emulsions of emulsions and these are generally known as multiple emulsions. These emulsions may be:

1) aqueous emulsions where the discontinuous phase comprises water and the continuous phase comprises the polyether siloxane copolymer network of the present invention;
2) aqueous emulsions where the continuous phase comprises the polyether siloxane copolymer network of the present invention and the discontinuous phase comprises water;
3) non-aqueous emulsions where the discontinuous phase comprises a non-aqueous hydroxylic solvent and the continuous phase comprises the polyether siloxane copolymer network of the present invention; and
4) non-aqueous emulsions where the continuous phase comprises a non-aqueous hydroxylic organic solvent and the discontinuous phase comprises the polyether siloxane copolymer network of the present invention.

Non-aqueous emulsions comprising a silicone phase are described in US patent 6,060,546 and co-pending application US Ser. No. 09/033,788 filed

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March 3,1998 the disclosures of which are herewith and hereby specifically incorporated by reference.

As used herein the term "non-aqueous hydroxylic organic compound" means hydroxyl containing organic compounds exemplified by alcohols, glycols, polyhydric alcohols and polymeric glycols and mixtures thereof that are liquid at room temperature, e.g. about 25 °C, and about one atmosphere pressure. The non-aqueous organic hydroxylic solvents are selected from the group consisting of hydroxyl containing organic compounds comprising alcohols, glycols, polyhydric alcohols and polymeric glycols and mixtures thereof that are liquid at room temperature, e.g. about 25 °C, and about one atmosphere pressure. Preferably the non-aqueous hydroxylic organic solvent is selected from the group consisting of ethylene glycol, ethanol, propyl alcohol, iso-propyl alcohol, propylene glycol, dipropylene glycol, tripropylene glycol, butylene glycol, iso-butylene glycol, methyl propane diol, glycerin, sorbitol, polyethylene glycol, polypropylene glycol mono alkyl ethers, polyoxyalkylene copolymers and mixtures thereof.

Once the desired form is attained whether as a silicone only phase, an anhydrous mixture comprising the silicone phase, a hydrous mixture comprising the silicone phase, a water-in-oil emulsion, an oil-in-water emulsion, or either of the two non-aqueous emulsions or variations thereon, the resulting material is usually a high viscosity cream with good feel characteristics, and high absorbance of volatile siloxanes. It is capable of being blended into formulations for hair care, skin care, antiperspirants, sunscreens, cosmetics, color cosmetics, insect repellants, vitamin and hormone carriers, fragrance carriers and the like.

The personal care applications where the polyether siloxane copolymer network of the present invention and the silicone compositions derived

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therefrom of the present invention may be employed include, but are not limited to, deodorants, antiperspirants, antiperspirant/deodorants, shaving products, skin lotions, moisturizers, toners, bath products, cleansing products, hair care products such as shampoos, conditioners, mousses, styling gels, hair sprays, hair dyes, hair color products, hair bleaches, waving products, hair straighteners, manicure products such as nail polish, nail polish remover, nails creams and lotions, cuticle softeners, protective creams such as sunscreen, insect repellent and anti-aging products, color cosmetics such as lipsticks, foundations, face powders, eye liners, eye shadows, blushes, makeup, mascaras and other personal care formulations where silicone components have been conventionally added, as well as drug delivery systems for topical application of medicinal compositions that are to be applied to the skin.

In a preferred embodiment, the personal care composition of the present invention further comprises one or more personal care ingredients. Suitable personal care ingredients include, for example, emollients, moisturizers, humectants, pigments, including pearlescent pigments such as, for example, bismuth oxychloride and titanium dioxide coated mica, colorants, fragrances, biocides, preservatives, antioxidants, anti-microbial agents, anti-fungal agents, antiperspirant agents, exfoliants, hormones, enzymes, medicinal compounds, vitamins, salts, electrolytes, alcohols, polyols, absorbing agents for ultraviolet radiation, botanical extracts, surfactants, silicone oils, organic oils, waxes, film formers, thickening agents such as, for example, fumed silica or hydrated silica, particulate fillers, such as for example, talc, kaolin, starch, modified starch, mica, nylon, clays, such as, for example, bentonite and organo-modified clays.

Suitable personal care compositions are made by combining, in a manner known in the art, such as, for example, by mixing, one or more of the

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above components with the polyether siloxane copolymer network, preferably in the form of the silicone composition of the present invention. Suitable personal care compositions may be in the form of a single phase or in the form of an emulsion, including oil-in-water, water-in-oil and anhydrous emulsions where the silicone phase may be either the discontinuous phase or the continuous phase, as well as multiple emulsions, such as, for example, oil-in water-in-oil emulsions and water-in-oil-in water-emulsions.

In one useful embodiment, an antiperspirant composition comprises the polyether siloxane copolymer network of the present invention and one or more active antiperspirant agents. Suitable antiperspirant agents include, for example, the Category I active antiperspirant ingredients listed in the U.S. Food and Drug Administration's October 10, 1993 Monograph on antiperspirant drug products for over-the-counter human use, such as, for example, aluminum halides, aluminum hydroxyhalides, for example, aluminum chlorohydrate, and complexes or mixtures thereof with zirconyl oxyhalides and zirconyl hydroxyhalides, such as for example, aluminum-zirconium chlorohydrate, aluminum zirconium glycine complexes, such as, for example, aluminum zirconium tetrachlorohydrex gly.

In another useful embodiment, a skin care composition comprises the polyether siloxane copolymer network, preferably in the form of silicone composition of the present invention, and a vehicle, such as, for example, a silicone oil or an organic oil. The skin care composition may, optionally, further include emollients, such as, for example, triglyceride esters, wax esters, alkyl or alkenyl esters of fatty acids or polyhydric alcohol esters and one or more the known components conventionally used in skin care compositions, such as, for example, pigments, vitamins, such as, for example, Vitamin A, Vitamin C and Vitamin E, sunscreen or sunblock compounds, such as, for example, titanium dioxide, zinc oxide, oxybenzone, octylmethoxy cinnamate, butylmethoxy dibenzoylm ethane, p-aminobenzoic acid and octyl dimethyl-p-aminobenzoic acid.

In another useful embodiment, a color cosmetic composition, such as, for example, a lipstick, a makeup or a mascara composition comprises the polyether siloxane copolymer network, preferably in the form of silicone composition of the present invention, and a coloring agent, such as a pigment, a water soluble dye or a liposoluble dye.

In another useful embodiment, the compositions of the present invention are utilized in conjunction with fragrant materials. These fragrant materials may be fragrant compounds, encapsulated fragrant compounds, or fragrance releasing compounds that either the neat compounds or are encapsulated. Particularly compatible with the compositions of the present invention are the fragrance releasing silicon containing compounds as disclosed in US patents 6,046,156; 6,054,547; 6,075,111; 6,077,923; 6,083,901; and 6,153,578; all of which are herein and herewith specifically incorporated by reference.

The uses of the compositions of the present invention are not restricted to personal care compositions, other products such as waxes, polishes and textiles treated with the compositions of the present invention are also contemplated.

Experimental Preparation of Polyether Siloxane Copolymer Network Compositions

Preparation Example 1. 494.5 g of a hydride fluid with approximate composition $M^HD_{300}D^H_4M^H$ was mixed with 5.5 g of vinyl cyclohexene oxide, 1500 g of decamethyl cyclopentasiloxane (D5), and 0.1 g of a platinum divinyltetramethyldisiloxane catalyst solution. The result was heated to 80

°C. After a couple of hours, an additional portion of platinum catalyst solution was added. The material was heated for a total of 4 hours at 80 °C. In this way a gel material ExpMJO-07-391 was obtained with a solids content of about 26%. 567 g of ExpMJO-07-391 was then mixed with 1433 g of additional D5. Then the result was passed twice through a Gaulin homogenizer at 4500 psi. The result, ExpMJO-07-401 had a solids content of about 7.3% and a viscosity of 24,200 cps. This material gave a very silky feel when rubbed on the skin.

Preparation Example 2. 300 g of a hydride fluid with approximate composition $M^HD_{337}\ D^H_{11.8}M^H$ was mixed with 3.94 g of vinyl cyclohexene oxide, 37 g of Gulftene C30+ Alpha Olefin Fraction from Chevron (herein defined when a substituent as C30+), 1022.8 g of decamethyl cyclopentasiloxane (D5), and 0.1 g of a platinum divinyltetramethyldisiloxane catalyst solution. The result was heated to 80 °C for 8 hours producing ExpMJO-07-433. This material had a solids content of about 25.5%. 587.5 g of ExpMJO-07-433 was then swollen with 1412.5 g of additional D5 and then passed through a Gaulin homogenizer at 4500 psi. The result, ExpMJO-07-434, had a solids content of about 7.4% and a viscosity of 45,000 cps. It also gave a silky feel when rubbed on the skin.

Preparation Example 3. 300 g of a hydride fluid with approximate composition $M^H{}_{1.73}D_{388}\ D^H{}_{6.9}M_{0.27}$ was mixed with 3.00 g of vinyl cyclohexene oxide, 9 g of Gulftene C30+ Alpha Olefin Fraction from Chevron, 936 g of decamethyl cyclopentasiloxane (D5), and 0.1 g of a platinum divinyltetramethyldisiloxane catalyst solution. The result was heated to 80 °C for 8 hours producing ExpMJO-07-422. This material had a solids content of about 25.7%. 591.4 g of ExpMJO-07-422 was then swollen with 1408.6 g of additional D5 and then passed through a Gaulin homogenizer at 4500 psi.

The result, ExpMJO-07-437, had a solids content of about 7.26% and a viscosity of 39,000 cps.

Preparation Example 4. 300 g of a hydride fluid with approximate composition $M^{H}{}_{1.73}D_{388}\,D^{H}{}_{6.9}M_{0.27}$ was mixed with 3.00 g of vinyl cyclohexene oxide, 3 g of a C-16/18 Alpha Olefin Fraction, 918 g of decamethyl cyclopentasiloxane (D5), and 0.1 g of a platinum divinyltetramethyldisiloxane catalyst solution. The result was heated to 80 °C for 8 hours producing ExpMJO-07-424. This material had a solids content of about 25.7%. 591.4 g of ExpMJO-07-424 was then swollen with 1408.6 g of additional D5 and then passed through a Gaulin homogenizer at 4500 psi. The result, ExpMJO-07-438, had a solids content of about 7.57% and a viscosity of 39,500 cps.

Preparation Example 5. 300 g of a hydride fluid with approximate composition $M^{H}D_{337}\,D^{H}{}_{11.8}M^{H}$ was mixed with 4.89 g of vinyl cyclohexene oxide, 26.4 g of Gulftene C30+ Alpha Olefin Fraction from Chevron, 733 g of decamethyl cyclopentasiloxane (D5), and 0.08 g of a platinum divinyltetramethyldisiloxane catalyst solution. The result was heated to 80 °C for 6 hours producing ExpMJO-07-464. This material had a solids content of about 30.84%. 533 g of ExpMJO-07-464 was then swollen with 967 g of additional D5 and then passed through a Gaulin homogenizer at 4500 psi. The result, ExpMJO-07-465, had a solids content of about 11% and a viscosity of 200,000 cps.

Preparation Example 6. 300 g of a hydride fluid with approximate composition $MD_{100}\,D^{H}{}_{10.5}M$ was mixed with 13.53 g of vinyl cyclohexene oxide, 34.84 g of Gulftene C30+ Alpha Olefin Fraction from Chevron, 647 g of decamethyl cyclopentasiloxane (D5), and 0.10 g of a platinum divinyltetramethyldisiloxane catalyst solution. The result was heated to 80°C for 6 hours producing ExpMJO-07-477. This material had a solids content of about 35.25%. 533 g of ExpMJO-07-464 was then swollen with 947 g of additional D5 and then passed through a Gaulin homogenizer at 4500 psi. The result, ExpMJO-07-482, had a solids content of about 12.69% and a viscosity of 16,500 cps.

Preparation Example 7. 316.4 g of a hydride fluid with approximate composition $M^HD_{200}\ D^H_{10.5}M^H$ was mixed with 7.56 g of vinyl cyclohexene oxide 7.00g of 4-allyl-2-methoxy-phenol, 840 g of decamethyl cyclopentasiloxane (D5), and 0.09 g of a platinum divinyltetramethyldisiloxane catalyst solution. The result was heated to 80 °C for 6 hours producing ExpMJO-08-537. 418 g of ExpMJO-08-537 was then swollen with 582 g of additional D5 and then passed through a Gaulin homogenizer at 8000 psi. The result, ExpMJO-08-540, had a solids content of about 12% and a viscosity of 198,000 cps.

Preparation Example 8. Example Showing Gelation Followed by Hydrosilyation. 300 g of a hydride fluid with approximate composition $M^HD_{337}\ D^H_{11.8}M^H$ was mixed with 3.94 g of vinyl cyclohexene oxide, 905.4 g of decamethyl cyclopentasiloxane (D5), and 0.1 g of a platinum divinyltetramethyl disiloxane catalyst solution. The result was heated to 80 °C for 4 hours with good mixing. A small sample of the gelled reaction mixture was taken out and analyzed by FTIR. This clearly showed that there was residual SiH remaining. Next, a mixture of 30 g of the di isostearic acid ester of trimethylolpropane monoallyl ether, 100g of D5 and 1 drop of Pt catalyst was added. The result was heated for another 2 hours at 80 °C. At this end of this time a gel was obtained (Gel E) which had a solids content of 25.1%. FTIR analysis showed that the size of the SiH stretch (ca. 2140 cm-1) had substantially decreased.

Preparation Example 9. Example Showing Addition of a Concentrated Hydridosiloxane. 300 g of a hydride fluid with approximate composition $M^H_{1.73}D_{388}\ D^H_{6.9}M_{0.27}$ was mixed with 3.00 g of vinyl cyclohexene oxide, 4.00 g of 4-allyl-2-methoxy-phenol, 20.8 g of Gulftene C30+ Alpha Olefin Fraction from Chevron, 984 g of decamethyl cyclopentasiloxane (D5), and 0.1 g of a platinum divinyltetramethyl disiloxane catalyst solution. The result was heated to 80 °C for an hour with good mixing. At this point, a mixture of 4 g of a trimethylsilyl stopped methyl hydrogen polsiloxane and 5 g decamethyl cyclopentasiloxane was added. With 3 minutes, the reaction mixture gelled. Heating was continued for 5 hours in order to ensure complete reaction.

Preparation Example 10 300 g of a hydride fluid with approximate composition $M^HD_{200}\ D^H_{10.5}M^H$ was mixed with 7.22 g of vinyl cyclohexene oxide, 34.1 g of Gulftene C30+ Alpha Olefin Fraction from Chevron, 796 g of decamethyl cyclopentasiloxane (D5), and 0.085 g of a platinum divinyltetramethyldisiloxane catalyst solution. The result was heated to 80 °C for 6 hours producing ExpMJO-07-481. 562 g of ExpMJO-07-481 was then swollen with a mixture of 938 g of additional D5 and 1.0 g of a 10% solution of methyl di(hydrogenated tallow)amine in Isopar C and then passed through a Gaulin homogenizer at 4500 psi. The result, ExpMJO-07-484, had a solids content of about 11.58% and a viscosity of 85,000 cps.

Experimental Preparation of Cosmetic Compositions Using Polyether Siloxane Copolymer Network Compositions

Cosmetic Example 1

Composition	wt% A(Control)	wt% B(Ex1)
Stearyl alcohol	15	15
Hydrogenated castor oil	5	5
Isododecane	10	10

SF1202	45	35
Talc	1	1
Al Zr Trichlorohydrex Gly	24	24
ExpMJO-07-465	0	10

These antiperspirant sticks were made by heating stearyl alcohol, hydrogenated castor oil, isododecane, SF1202 and ExpMJO-07-465 until the gellants were melted . Al Zr Trichlorohydrex gly was added to the batch at 70°C and mixed until uniform. Antiperspirants were poured to containers at about 60°C. The antiperspirant was evaluated for whiteness, ability to hold liquid, feel, and hardness of the stick. The whiteness was determined by applying antiperspirant onto dark color vinyl slides to mimic the consumer application methods. Vinyl test slides were air dried for 15 min and the whiteness was determined by appearance. The control antiperspirants showed intense whiteness within 5-10 min after application. The antiperspirant B showed whiteness reduction as compared to control. Antiperspirant B also demonstrated a superior ability to hold cosmetic fluid when using thumb pressure was applied to the sticks. It also improved the rigidity and resiliency of the stick in this formulation. In addition, it provided lubricious skin feel with powdery finish. Formulation B also modified the crystallization of organic gelling agents by providing a better and more uniform matrix and reducing the growth of stearyl alcohol crystallization matrix.

Cosmetic Example 2

Composition	A	B(Ex2)
Part A	wt%	wt%
Propylene glycol	42.2	42.2
Hydroxypropyl cellulose	0.5	0.5

DBS	2	2
Part B		
30% Al Zr Pentachlorohydrex gly in propylene glycol	30	30
Part C		
SF1202	10	0
ExpMJO-07-465	0	10
SF1555	15	15
40% Dimethicone copolyol in D5	0.3	0.3

These clear antiperspirant sticks were prepared by heating propylene glycol to 80°C and slowly sprinkling in hydroxypropyl cellulose(HPC). After the HPC was uniformly dispersed, the mixture was heated up to 130°C and DBS was added to the batch. The glycol mixture was cooled down to 100°C when a solution of the antiperspirant active was added. The silicone phase or part C was separately mixed and heated to 80°C and then the glycol phase was slowly introduced to the silicone phase.

The clear antiperspirant B in this invention showed no syneresis and increased stiffness of the stick compared to control. It gave good pay-out and smooth uniform deposition of antiperspirant active on the skin when compared to control.

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Cosmetic Example 3 and 4

Ingredients	A	B(Ex3)	C	D(Ex4)
Part A	Wt%	Wt%	Wt%	Wt%
SF1202	21.65	11.65	19.2	9.9
Isododecane	8.7	8.7		
Caprylic/capric Triglyceride	3.6	3.6		
Dimethicone			9.3	9.3
Phenyl trimethicone			9.3	9.3
Sorbitan oleate	1.5	1.5	1.4	1.4
40% Dimethicone copolyol in D5	3.75	3.75	3.5	3.5
ExpMJO-07-465		10		
ExpMJO-07-434				9.3
Part B				
Iron oxides(red, yellow, black)	2.34	2.34	2.18	2.18
TiO_2	8.73	8.73	8.11	8.11
10% Dimethicone copolyol in D5	6.63	6.63	6.15	6.15
Part C				
Deionized water	37.75	37.75	34.98	34.98
Butylene glycol	5	5	4.65	4.65
Xanthan gum	0.1	0.1	0.1	0.1
C_{11-15} Pareth-7	0.25	0.25	0.23	0.23
Magnesium sulfate			0.9	0.9

Parameter	Foundation A	Foundation B(Ex3)	Foundation C	Foundation D(Ex4)
Degree of coverage[1]	-	Excellent	-	Excellent
Gloss	3.2	3.2	17.2	11.6
Appearance after 5 cycles of wash off [2]	NA	NA	Washed away	Partially washed away, the remaining foundation showed powdery finish.

Note: 1 = Degree of coverage was conducted against the control. Formulation A was the control of formulation B and formulation C was the control of formulation D.

2 = Formulation C and D was tested for appearance of foundation coated on vinyl slides after 5 cycles of wash off. The wash off resistance method was described in ASTM D1913.

The foundations were prepared by mixing part A and part B together at room temperature until uniform. The emulsion was developed when the water phase (Part C) was added into the oil phase. The foundation samples were evaluated for coverage on vinyl slides at 24 micron in thickness. All foundations were evaluated on ease of spreadability during draw down, appearance, degree of coverage and shine. Shine was determined by using gloss meter after 12 hours. In this study formulation B was evaluated against formulation A(control) and formulation D was evaluated against formulation C(control).

Formulation B gave superior uniform coverage by reducing the appearance of lines and imperfections on the vinyl slides, and by reducing shine during initial rub-out. However, both formulation A and B did not show the difference in gloss after 12 hours. Formulation B imparted a

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luxurious silky feel with a powdery finish appearance. The foundation B in this invention had improved stability after one week at room temperature compared to the formulation A(control) which showed syneresis at the same time.

Formulation D gave the similar benefits as described in formulation B. In addition, it also provided wash off resistance which made personal care products more durable to perspiration or during swimming. Formulation D had an ability to control shine as shown in the result above.

Cosmetic Example 5 and 6

These two examples were prepared to illustrate organic compatibility of silicone gel in this invention and compared it with the current elastomer gel with an INCI name of cyclopentasiloxane (and) dimethicone/vinyl dimethicone crosspolymer (SFE839).

Cosmetic Example 5

Composition	Appearance
25% Petrolatum in SFE839	fluid
25% Petrolatum in ExpMJO-07-465	gel

When petrolatum was mixed with SFE839, the formulation lost the structure and became an opaque fluid mixture. This suggested the incompatibility of petrolatum and SFE839. On the other hand, when petrolatum was incorporated into the gel of this invention, the gel had an ability to maintain product integrity, indicating the compatibility of this gel and petrolatum.

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Cosmetic Example 6

Composition	Appearance
50% Cetearyl methicone in SFE839	Incompatible
50% Cetearyl methicone in ExpMJO-07-465	Compatible

Cetearyl methicone is a linear alkyl substituted silicone and it provides moisturization to the formulation by creating an occlusive barrier on the skin. When this silicone moisturizer was combined with the new gel, it showed good compatibility whereas the SFE839 did not In addition, the gel according to this invention is easier to blend with cosmetic ingredients in that it does not require the high shear mixer or lengthy mixing time required by SFE839.

Cosmetic Example 7

This skin treatment gel was prepared by combining all ingredients listed below until uniform at room temperature. The gel was used as delivery system for skin treatment and it is suitable for both heat sensitive and non-heat sensitive active ingredients since it does not require heating during manufacturing. The absence of water in this formulation ensures the efficacy of vitamin C until used.

Composition	wt%
Polymethylsilsesquioxane(Tospearl2000B)	0.5
Vitamin C	1
Hydrogenated polydecene	10
ExpMJO-07-434	88.5

Cosmetic Example 8

A lip treatment comprising ingredients below is useful for contouring, durability and moisturization feel.

Composition	wt%
ExpMJO-07-465	89
Phenylpropyldimethylsiloxysilicate	10
Nylon-12	1

Cosmetic Example 9

Silky body lotion is made by combining part A together and heating to 80°C. In a separate vessel, part B is mixed and heated to 75°C. The emulsion is formed when part A and part B are added together under high shear mixing. This lotion provides light and lubricious skin feel.

Composition

Part A	wt%
ExpMJO-07-465	10
Caprylic/capric triglyceride	5
$C_{30\text{-}45}$ Alkyl Dimethicone	5
Glyceryl stearate(and) PEG-100 stearate	4

Part B	
Water	q.s.
Xanthan gum	0.1
Glycerin	2
Preservatives, color, fragrance	1

Cosmetic Examples 10-13

Water resistant lotions useful for various personal care products were prepared by combining part A and part B together at room temperature. The lotions were then applied on glass slides and tested for degree of water resistance using the method described in ASTM D1913. The degree of wash off resistance is the numbers of wash off cycles taken before the lotion was completely washed away. The body lotion B-E with the new gel in this invention showed water resistant benefit as shown below.

Composition	A	B	C	D	E
Cosmetic Examples	Control	10	11	12	13
Part A	wt%	wt%	wt%	wt%	
wt%					
Sorbitan oleate	0.6	0.6	0.6	0.6	0.6
10% Dimthicone copolyol in D5	10	10	10	10	10
SF1202	16	4	4	4	4
ExpMJO-07-401	0	12	0	0	0
ExpMJO-07-437	0	0	12	0	0
ExpMJO-07-434	0	0	0	12	0
ExpMJO-07-438	0	0	0	0	12

Part B

Glycerin	1	1	1	1	1
Sodium chloride	1	1	1	1	1
Quaternium-15	0.1	0.1	0.1	0.1	0.1
Water	q.s.	q.s.	q.s.	q.s.	q.s.

Wash off resistant result

Formulation	Cycles of wash off
A(control)	5
B	15
C	15
D	15
E	10

Cosmetic Example 14

Hair shampoo comprising ingredients below gives a silky feel to hair fibers. This shampoo can be prepared into 2 ways; one is directly add silicone gel to the shampoo, and the other is pre-blend silicone gel with at least one surfactant and water until emulsion developed and add silicone gel emulsion to the shampoo.

This shampoo is made by mixing ingredients as ordered.

Compositions	wt%
Ammonium lauryl sulfate	35
Cocamidopropyl betaine	5
Water	56.6
Preservative	0.01
Acrylate/$C_{10\text{-}30}$ alkyl acrylate crosspolymer	0.8
Sodium hydroxide	adjust to pH 7.5

ExpMJO-07-465	2.5
Citric acid	adjust to pH 6

Cosmetic Example 15

This hair conditioner for daily use provides softness, lubricity and body.

Composition	wt%
Deionized water	93
Hydroxyethylcellulose	1.5
Silicone gel emulsion	2
Cetrimonium chloride	3
Preservatives, color, fragrance	q.s.

Cosmetic Example 16

The leave on hair conditioner reduces fly-away and increases body and volume.

Composition	wt%
ExpMJO-07-465	50
Dimethicone copolyol	5
Isododecane	45

Cosmetic Example 17

This soft solid antiperspirant contains silicone gel an anti-syneresis, thickening and sensory enhancer. The gel shows excellent organic compatibility. It is used in combination with an organic thickener to achieve the desired texture and rigidity.

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Ingredient	Part/Wt (%)
Cyclopentasiloxane (SF1202)	37.0
Dimethicone (SF96-10)	8.0
C12-15 Alkyl Benzoate	8.0
Hydrogenated Castor Oil (mp 70°C)	7.0
C18-36 Acid Triglyceride	7.0
ExpMJO-07-484	5.0
Talc	3.0
Aluminum Zirconium Tetrachlorohydrex Gly	25.0

Cosmetic Example 18

This silicone lipstick contains silicone gel to soften lips. There are two silicones, SF1528, and Exp-MJO-07-484, which give a unique soft silky feel. Sunscreens could be added to the formulations for solar protection.

Ingredient	Part/Wt (%)
Cyclopentasiloxane (and) PEG/PPG-20/15	
Dimethicone (SF1528)	20.0
ExpMJO-07-484	40.0
C18-36 Acid Triglyceride	5.0
Ozokerite	3.0
Polyethylene	5.0
Isododecane	20.0
D&C Red No.7 Ca Lake	7.0

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Materials listed as SFxxxx are commercially available silicone materials available from GE Silicones, 260 Hudson River Road, Waterford NY 12188.

These examples are to be construed as exemplary in nature only and are not intended in any way to limit the appended claims. It is contemplated that a person having ordinary skill in the art would be able to produce obvious variations of the subject matter and disclosures herein contained that would be by reason of such ordinary skill within the literal or equitable scope of the appended claims.

CLAIMS

Having described the Invention that which is claimed is:

1. A cosmetic composition comprising the reaction product of:

$M_aM^H_bM^E_cD_dD^H_eD^E_f T_gT^H_hT^E_iQ_j$

where

$M = R^1R^2R^3SiO_{1/2}$;

$M^H = R^4R^5H\ SiO_{1/2}$;

$M^E = R^6R^7R^ESiO_{1/2}$;

$D = R^8R^9SiO_{2/2}$;

$D^H = R^{10}HSiO_{2/2}$;

$D^E = R^{11}R^ESiO_{2/2}$;

$T = R^{12}SiO_{3/2}$;

$T^H = HSiO_{3/2}$;

$T^E = R^ESiO_{3/2}$; and

$Q = SiO_{4/2}$;

where R^1, R^2, R^3, R^8, R^9 and R^{12} are independently monovalent hydrocarbon radicals having from one to sixty carbon atoms; R^4, R^5 and R^{10} are independently monovalent hydrocarbon radicals having from one to sixty carbon atoms or hydrogen; R^6, R^7, R^{11} are independently monovalent hydrocarbon radicals having from one to sixty carbon atoms or R^E; each R^E is independently a monovalent hydrocarbon radical containing one or more oxirane moieties having from one to sixty carbon atoms; the stoichiometric subscripts a, b, c, d, e, f, g, h, i, and j are either zero or positive subject to the following limitations: $a + b + c > 1$; $b + e + h > 1$; $c + f + i > 1$; $b + e + h > c + f + i$; and when $d + e + f + g + h + i + j = 0$, $a + b + c = 2$.

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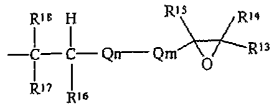
2. The composition of claim 1 where R^E has the formula:



where R^{13}, R^{14}, R^{15}, R^{16}, R^{17} and R^{18} are each independently selected from the group of hydrogen and monovalent hydrocarbon radicals having from one to sixty carbon atoms, Q_m is a di- or trivalent hydrocarbon radical having from one to sixty carbon atoms, Q_n is a divalent hydrocarbon radical having from one to sixty carbon atoms with the subscripts m and n independently zero or one subject to the limitation that when Qm is trivalent one of R^{13} or R^{14} is absent.

3. The composition of claim 1 where R^E is selected from the group consisting of 4-vinyl cyclohexene oxide, allyl glycidyl ether, limonene oxide, 1,2-epoxy-5-hexene, 1,2-epoxy-7-octene, norbornadiene monoepoxide and 1,2-epoxy-9-decene.

4. The composition of claim 2 where R^{13}, R^{14}, R^{15}, R^{16}, R^{17} and R^{18} are hydrogen and m and n are zero.

5. The composition of claim 3 where R^E is 4-vinyl cyclohexene oxide.

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6. The composition of claim 1 where R^1, R^2, R^3, R^8, R^9 and R^{12} are independently selected from the group consisting of methyl, ethyl, sec-butyl, tert-butyl, octyl, decyl, dodecyl, cetyl, stearyl, ethenyl, propenyl, butynyl, hydroxypropyl, butoxy, 2,5,8-trioxadecanyl, carboxymethyl, chloromethyl, C30+ and 3,3,3-fluoropropyl.

7. The composition of claim 2 where R^1, R^2, R^3, R^8, R^9 and R^{12} are independently selected from the group consisting of methyl, ethyl, sec-butyl, tert-butyl, octyl, decyl, dodecyl, cetyl, stearyl, ethenyl, propenyl, butynyl, hydroxypropyl, cyanoethyl, butoxy, 2,5,8-trioxadecanyl, carboxymethyl, chloromethyl and 3,3,3-fluoropropyl.

8. The composition of claim 3 where R^1, R^2, R^3, R^8, R^9 and R^{12} are independently selected from the group consisting of methyl, ethyl, sec-butyl, tert-butyl, octyl, decyl, dodecyl, cetyl, stearyl, ethenyl, propenyl, butynyl, hydroxypropyl, cyanoethyl, butoxy, 2,5,8-trioxadecanyl, carboxymethyl, chloromethyl and 3,3,3-fluoropropyl.

9. The composition of claim 4 where R^1, R^2, R^3, R^8, R^9 and R^{12} are independently selected from the group consisting of methyl, ethyl, sec-butyl, tert-butyl, octyl, decyl, dodecyl, cetyl, stearyl, ethenyl, propenyl, butynyl, hydroxypropyl, cyanoethyl, butoxy, 2,5,8-trioxadecanyl, carboxymethyl, chloromethyl and 3,3,3-fluoropropyl.

10. The composition of claim 5 where R^1, R^2, R^3, R^8, R^9 and R^{12} are independently selected from the group consisting of methyl, ethyl, sec-butyl, tert-butyl, octyl, decyl, dodecyl, cetyl, stearyl, ethenyl, propenyl, butynyl, hydroxypropyl, cyanoethyl, butoxy, 2,5,8-trioxadecanyl, carboxymethyl, chloromethyl and 3,3,3-fluoropropyl.

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11. A cosmetic composition comprising an aqueous emulsion where the discontinuous phase comprises water and the continuous phase comprises a composition comprising the reaction product of:

$M_aM^H_bM^E_cD_dD^H_eD^E_f\ T_gT^H_hT^E_iQ_j$

where

$M = R^1R^2R^3SiO_{1/2}$;

$M^H = R^4R^5H\ SiO_{1/2}$;

$M^E = R^6R^7R^ESiO_{1/2}$;

$D = R^8R^9SiO_{2/2}$;

$D^H = R^{10}HSiO_{2/2}$;

$D^E = R^{11}R^ESiO_{2/2}$;

$T = R^{12}SiO_{3/2}$;

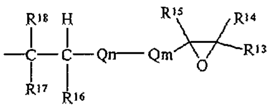
$T^H = HSiO_{3/2}$;

$T^E = R^ESiO_{3/2}$; and

$Q = SiO_{4/2}$;

where R^1, R^2, R^3, R^8, R^9 and R^{12} are independently monovalent hydrocarbon radicals having from one to sixty carbon atoms; R^4, R^5 and R^{10} are independently monovalent hydrocarbon radicals having from one to sixty carbon atoms or hydrogen; R^6, R^7, R^{11} are independently monovalent hydrocarbon radicals having from one to sixty carbon atoms or R^E; each R^E is independently a monovalent hydrocarbon radical containing one or more oxirane moieties having from one to sixty carbon atoms; the stoichiometric subscripts a, b, c, d, e, f, g, h, i, and j are either zero or positive subject to the following limitations: $a + b + c > 1$; $b + e + h > 1$; $c + f + i > 1$; $b + e + h > c + f + i$; and when $d + e + f + g + h + i + j = 0$, $a + b + c = 2$.

12. The composition of claim 11 where R^E has the formula:



where R^{13}, R^{14}, R^{15}, R^{16}, R^{17} and R^{18} are each independently selected from the group of hydrogen and monovalent hydrocarbon radicals having from one to sixty carbon atoms, Q_m is a di- or trivalent hydrocarbon radical having from one to sixty carbon atoms, Q_n is a divalent hydrocarbon radical having from one to sixty carbon atoms with the subscripts m and n independently zero or one subject to the limitation that when Qm is trivalent one of R^{13} or R^{14} is absent.

13. The composition of claim 11 where R^E is selected from the group consisting of 4-vinyl cyclohexene oxide, allyl glycidyl ether, limonene oxide, 1,2-epoxy-5-hexene, 1,2-epoxy-7-octene, norbornadiene monoepoxide and 1,2-epoxy-9-decene.

14. The composition of claim 12 where R^{13}, R^{14}, R^{15}, R^{16}, R^{17} and R^{18} are hydrogen and m and n are zero.

15. The composition of claim 13 where R^E is 4-vinyl cyclohexene oxide.

16. The composition of claim 11 where R^1, R^2, R^3, R^8, R^9 and R^{12} are independently selected from the group consisting of methyl, ethyl, sec-butyl, tert-butyl, octyl, decyl, dodecyl, cetyl, stearyl, ethenyl, propenyl, butynyl, hydroxypropyl, butoxy, 2,5,8-trioxadecanyl, carboxymethyl, chloromethyl, C30+ and 3,3,3-fluoropropyl.

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17. The composition of claim 12 where R^1, R^2, R^3, R^8, R^9 and R^{12} are independently selected from the group consisting of methyl, ethyl, sec-butyl, tert-butyl, octyl, decyl, dodecyl, cetyl, stearyl, ethenyl, propenyl, butynyl, hydroxypropyl, cyanoethyl, butoxy, 2,5,8-trioxadecanyl, carboxymethyl, chloromethyl and 3,3,3-fluoropropyl.

18. The composition of claim 13 where R^1, R^2, R^3, R^8, R^9 and R^{12} are independently selected from the group consisting of methyl, ethyl, sec-butyl, tert-butyl, octyl, decyl, dodecyl, cetyl, stearyl, ethenyl, propenyl, butynyl, hydroxypropyl, cyanoethyl, butoxy, 2,5,8-trioxadecanyl, carboxymethyl, chloromethyl and 3,3,3-fluoropropyl.

19. The composition of claim 14 where R^1, R^2, R^3, R^8, R^9 and R^{12} are independently selected from the group consisting of methyl, ethyl, sec-butyl, tert-butyl, octyl, decyl, dodecyl, cetyl, stearyl, ethenyl, propenyl, butynyl, hydroxypropyl, cyanoethyl, butoxy, 2,5,8-trioxadecanyl, carboxymethyl, chloromethyl and 3,3,3-fluoropropyl.

20. The composition of claim 15 where R^1, R^2, R^3, R^8, R^9 and R^{12} are independently selected from the group consisting of methyl, ethyl, sec-butyl, tert-butyl, octyl, decyl, dodecyl, cetyl, stearyl, ethenyl, propenyl, butynyl, hydroxypropyl, cyanoethyl, butoxy, 2,5,8-trioxadecanyl, carboxymethyl, chloromethyl and 3,3,3-fluoropropyl.

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21. A cosmetic composition comprising an aqueous emulsion where the discontinuous phase comprises water and the continuous phase comprises a composition comprising the reaction product of:

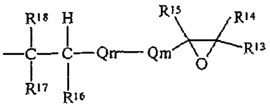
$M_aM^H_bM^E_cD_dD^H_eD^E_f\ T_gT^H_hT^E_iQ_j$

where

$M = R^1R^2R^3SiO_{1/2}$;
$M^H = R^4R^5H\ SiO_{1/2}$;
$M^E = R^6R^7R^ESiO_{1/2}$;
$D = R^8R^9SiO_{2/2}$;
$D^H = R^{10}HSiO_{2/2}$;
$D^E = R^{11}R^ESiO_{2/2}$;
$T = R^{12}SiO_{3/2}$;
$T^H = HSiO_{3/2}$;
$T^E = R^ESiO_{3/2}$; and
$Q = SiO_{4/2}$;

where R^1, R^2, R^3, R^8, R^9 and R^{12} are independently monovalent hydrocarbon radicals having from one to sixty carbon atoms; R^4, R^5 and R^{10} are independently monovalent hydrocarbon radicals having from one to sixty carbon atoms or hydrogen; R^6, R^7, R^{11} are independently monovalent hydrocarbon radicals having from one to sixty carbon atoms or R^E; each R^E is independently a monovalent hydrocarbon radical containing one or more oxirane moieties having from one to sixty carbon atoms; the stoichiometric subscripts a, b, c, d, e, f, g, h, i, and j are either zero or positive subject to the following limitations: $a + b + c > 1$; $b + e + h > 1$; $c + f + i > 1$; $b + e + h > c + f + i$; and when $d + e + f + g + h + i + j = 0$, $a + b + c = 2$.

22. The composition of claim 21 where R^E has the formula:



where R^{13}, R^{14}, R^{15}, R^{16}, R^{17} and R^{18} are each independently selected from the group of hydrogen and monovalent hydrocarbon radicals having from one to sixty carbon atoms, Q_m is a di- or trivalent hydrocarbon radical having from one to sixty carbon atoms, Q_n is a divalent hydrocarbon radical having from one to sixty carbon atoms with the subscripts m and n independently zero or one subject to the limitation that when Qm is trivalent one of R^{13} or R^{14} is absent.

23. The composition of claim 21 where R^E is selected from the group consisting of 4-vinyl cyclohexene oxide, allyl glycidyl ether, limonene oxide, 1,2-epoxy-5-hexene, 1,2-epoxy-7-octene, norbornadiene monoepoxide and 1,2-epoxy-9-decene.

24. The composition of claim 22 where R^{13}, R^{14}, R^{15}, R^{16}, R^{17} and R^{18} are hydrogen and m and n are zero.

25. The composition of claim 23 where R^E is 4-vinyl cyclohexene oxide.

26. The composition of claim 21 where R^1 , R^2, R^3, R^8, R^9 and R^{12} are independently selected from the group consisting of methyl, ethyl, sec-butyl, tert-butyl, octyl, decyl, dodecyl, cetyl, stearyl, ethenyl, propenyl, butynyl, hydroxypropyl, cyanoethyl, butoxy, 2,5,8-trioxadecanyl, carboxymethyl, chloromethyl, C30+ and 3,3,3-fluoropropyl.

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27. The composition of claim 22 where R^1, R^2, R^3, R^8, R^9 and R^{12} are independently selected from the group consisting of methyl, ethyl, sec-butyl, tert-butyl, octyl, decyl, dodecyl, cetyl, stearyl, ethenyl, propenyl, butynyl, hydroxypropyl, butoxy, 2,5,8-trioxadecanyl, carboxymethyl, chloromethyl and 3,3,3-fluoropropyl.

28. The composition of claim 23 where R^1, R^2, R^3, R^8, R^9 and R^{12} are independently selected from the group consisting of methyl, ethyl, sec-butyl, tert-butyl, octyl, decyl, dodecyl, cetyl, stearyl, ethenyl, propenyl, butynyl, hydroxypropyl, cyanoethyl, butoxy, 2,5,8-trioxadecanyl, carboxymethyl, chloromethyl and 3,3,3-fluoropropyl.

29. The composition of claim 24 where R^1, R^2, R^3, R^8, R^9 and R^{12} are independently selected from the group consisting of methyl, ethyl, sec-butyl, tert-butyl, octyl, decyl, dodecyl, cetyl, stearyl, ethenyl, propenyl, butynyl, hydroxypropyl, cyanoethyl, butoxy, 2,5,8-trioxadecanyl, carboxymethyl, chloromethyl and 3,3,3-fluoropropyl.

30. The composition of claim 25 where R^1, R^2, R^3, R^8, R^9 and R^{12} are independently selected from the group consisting of methyl, ethyl, sec-butyl, tert-butyl, octyl, decyl, dodecyl, cetyl, stearyl, ethenyl, propenyl, butynyl, hydroxypropyl, cyanoethyl, butoxy, 2,5,8-trioxadecanyl, carboxymethyl, chloromethyl and 3,3,3-fluoropropyl.

31. A cosmetic composition comprising a non-aqueous emulsion where the discontinuous phase comprises a non-aqueous hydroxylic solvent and the continuous phase comprises a composition comprising the reaction product of:

$M_aM^H_bM^E_cD_dD^H_eD^E_f\,T_gT^H_hT^E_iQ_j$

where

$M = R^1R^2R^3SiO_{1/2}$;

$M^H = R^4R^5H\ SiO_{1/2}$;

$M^E = R^6R^7R^ESiO_{1/2}$;

$D = R^8R^9SiO_{2/2}$;

$D^H = R^{10}HSiO_{2/2}$;

$D^E = R^{11}R^ESiO_{2/2}$;

$T = R^{12}SiO_{3/2}$;

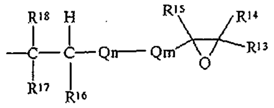
$T^H = HSiO_{3/2}$;

$T^E = R^ESiO_{3/2}$; and

$Q = SiO_{4/2}$;

where R^1, R^2, R^3, R^8, R^9 and R^{12} are independently monovalent hydrocarbon radicals having from one to sixty carbon atoms; R^4, R^5 and R^{10} are independently monovalent hydrocarbon radicals having from one to sixty carbon atoms or hydrogen; R^6, R^7, R^{11} are independently monovalent hydrocarbon radicals having from one to sixty carbon atoms or R^E; each R^E is independently a monovalent hydrocarbon radical containing one or more oxirane moieties having from one to sixty carbon atoms; the stoichiometric subscripts a, b, c, d, e, f, g, h, i, and j are either zero or positive subject to the following limitations: $a + b + c > 1$; $b + e + h > 1$; $c + f + i > 1$; $b + e + h > c + f + i$; and when $d + e + f + g + h + i + j = 0$, $a + b + c = 2$.

32. The composition of claim 31 where R^E has the formula:



where R^{13}, R^{14}, R^{15}, R^{16}, R^{17} and R^{18} are each independently selected from the group of hydrogen and monovalent hydrocarbon radicals having from one to sixty carbon atoms, Q_m is a di- or trivalent hydrocarbon radical having from one to sixty carbon atoms, Q_n is a divalent hydrocarbon radical having from one to sixty carbon atoms with the subscripts m and n independently zero or one subject to the limitation that when Qm is trivalent one of R^{13} or R^{14} is absent.

33. The composition of claim 31 where R^E is selected from the group consisting of 4-vinyl cyclohexene oxide, allyl glycidyl ether, limonene oxide, 1,2-epoxy-5-hexene, 1,2-epoxy-7-octene, norbornadiene monoepoxide and 1,2-epoxy-9-decene.

34. The composition of claim 32 where R^{13}, R^{14}, R^{15}, R^{16}, R^{17} and R^{18} are hydrogen and m and n are zero.

35. The composition of claim 33 where R^E is 4-vinyl cyclohexene oxide.

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36. The composition of claim 31 where R^1, R^2, R^3, R^8, R^9 and R^{12} are independently selected from the group consisting of methyl, ethyl, sec-butyl, tert-butyl, octyl, decyl, dodecyl, cetyl, stearyl, ethenyl, propenyl, butynyl, hydroxypropyl, butoxy, 2,5,8-trioxadecanyl, carboxymethyl, chloromethyl, C30+ and 3,3,3-fluoropropyl.

37. The composition of claim 32 where R^1, R^2, R^3, R^8, R^9 and R^{12} are independently selected from the group consisting of methyl, ethyl, sec-butyl, tert-butyl, octyl, decyl, dodecyl, cetyl, stearyl, ethenyl, propenyl, butynyl, hydroxypropyl, cyanoethyl, butoxy, 2,5,8-trioxadecanyl, carboxymethyl, chloromethyl and 3,3,3-fluoropropyl.

38. The composition of claim 33 where R^1, R^2, R^3, R^8, R^9 and R^{12} are independently selected from the group consisting of methyl, ethyl, sec-butyl, tert-butyl, octyl, decyl, dodecyl, cetyl, stearyl, ethenyl, propenyl, butynyl, hydroxypropyl, cyanoethyl, butoxy, 2,5,8-trioxadecanyl, carboxymethyl, chloromethyl and 3,3,3-fluoropropyl.

39. The composition of claim 34 where R^1, R^2, R^3, R^8, R^9 and R^{12} are independently selected from the group consisting of methyl, ethyl, sec-butyl, tert-butyl, octyl, decyl, dodecyl, cetyl, stearyl, ethenyl, propenyl, butynyl, hydroxypropyl, cyanoethyl, butoxy, 2,5,8-trioxadecanyl, carboxymethyl, chloromethyl and 3,3,3-fluoropropyl.

40. The composition of claim 35 where R^1, R^2, R^3, R^8, R^9 and R^{12} are independently selected from the group consisting of methyl, ethyl, sec-butyl, tert-butyl, octyl, decyl, dodecyl, cetyl, stearyl, ethenyl, propenyl, butynyl, hydroxypropyl, cyanoethyl, butoxy, 2,5,8-trioxadecanyl, carboxymethyl, chloromethyl and 3,3,3-fluoropropyl.

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41. A cosmetic composition comprising a non-aqueous emulsion where the continuous phase comprises a non-aqueous hydroxylic solvent and the discontinuous phase comprises a composition comprising the reaction product of:

$M_aM^H_bM^E_cD_dD^H_eD^E_f\,T_gT^H_hT^E_iQ_j$

where

$M = R^1R^2R^3SiO_{1/2}$;

$M^H = R^4R^5H\ SiO_{1/2}$;

$M^E = R^6R^7R^ESiO_{1/2}$;

$D = R^8R^9SiO_{2/2}$;

$D^H = R^{10}HSiO_{2/2}$;

$D^E = R^{11}R^ESiO_{2/2}$;

$T = R^{12}SiO_{3/2}$;

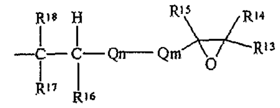
$T^H = HSiO_{3/2}$;

$T^E = R^ESiO_{3/2}$; and

$Q = SiO_{4/2}$;

where R^1, R^2, R^3, R^8, R^9 and R^{12} are independently monovalent hydrocarbon radicals having from one to sixty carbon atoms; R^4, R^5 and R^{10} are independently monovalent hydrocarbon radicals having from one to sixty carbon atoms or hydrogen; R^6, R^7, R^{11} are independently monovalent hydrocarbon radicals having from one to sixty carbon atoms or R^E; each R^E is independently a monovalent hydrocarbon radical containing one or more oxirane moieties having from one to sixty carbon atoms; the stoichiometric subscripts a, b, c, d, e, f, g, h, i, and j are either zero or positive subject to the following limitations: $a + b + c > 1$; $b + e + h > 1$; $c + f + i > 1$; $b + e + h > c + f + i$; and when $d + e + f + g + h + i + j = 0$, $a + b + c = 2$.

42. The composition of claim 41 where R^E has the formula:



where R^{13}, R^{14}, R^{15}, R^{16}, R^{17} and R^{18} are each independently selected from the group of hydrogen and monovalent hydrocarbon radicals having from one to sixty carbon atoms, Q_m is a di- or trivalent hydrocarbon radical having from one to sixty carbon atoms, Q_n is a divalent hydrocarbon radical having from one to sixty carbon atoms with the subscripts m and n independently zero or one subject to the limitation that when Qm is trivalent one of R^{13} or R^{14} is absent.

43. The composition of claim 41 where R^E is selected from the group consisting of 4-vinyl cyclohexene oxide, allyl glycidyl ether, limonene oxide, 1,2-epoxy-5-hexene, 1,2-epoxy-7-octene, norbornadiene monoepoxide and 1,2-epoxy-9-decene.

44. The composition of claim 42 where R^{13}, R^{14}, R^{15}, R^{16}, R^{17} and R^{18} are hydrogen and m and n are zero.

45. The composition of claim 43 where R^E is 4-vinyl cyclohexene oxide.

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46. The composition of claim 41 where R^1, R^2, R^3, R^8, R^9 and R^{12} are independently selected from the group consisting of methyl, ethyl, sec-butyl, tert-butyl, octyl, decyl, dodecyl, cetyl, stearyl, ethenyl, propenyl, butynyl, hydroxypropyl, butoxy, 2,5,8-trioxadecanyl, carboxymethyl, chloromethyl, C30+ and 3,3,3-fluoropropyl.

47. The composition of claim 42 where R^1, R^2, R^3, R^8, R^9 and R^{12} are independently selected from the group consisting of methyl, ethyl, sec-butyl, tert-butyl, octyl, decyl, dodecyl, cetyl, stearyl, ethenyl, propenyl, butynyl, hydroxypropyl, cyanoethyl, butoxy, 2,5,8-trioxadecanyl, carboxymethyl, chloromethyl and 3,3,3-fluoropropyl.

48. The composition of claim 43 where R^1, R^2, R^3, R^8, R^9 and R^{12} are independently selected from the group consisting of methyl, ethyl, sec-butyl, tert-butyl, octyl, decyl, dodecyl, cetyl, stearyl, ethenyl, propenyl, butynyl, hydroxypropyl, cyanoethyl, butoxy, 2,5,8-trioxadecanyl, carboxymethyl, chloromethyl and 3,3,3-fluoropropyl.

49. The composition of claim 44 where R^1, R^2, R^3, R^8, R^9 and R^{12} are independently selected from the group consisting of methyl, ethyl, sec-butyl, tert-butyl, octyl, decyl, dodecyl, cetyl, stearyl, ethenyl, propenyl, butynyl, hydroxypropyl, cyanoethyl, butoxy, 2,5,8-trioxadecanyl, carboxymethyl, chloromethyl and 3,3,3-fluoropropyl.

50. The composition of claim 45 where R^1, R^2, R^3, R^8, R^9 and R^{12} are independently selected from the group consisting of methyl, ethyl, sec-butyl, tert-butyl, octyl, decyl, dodecyl, cetyl, stearyl, ethenyl, propenyl, butynyl, hydroxypropyl, cyanoethyl, butoxy, 2,5,8-trioxadecanyl, carboxymethyl, chloromethyl and 3,3,3-fluoropropyl.

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51. The cosmetic composition of claim 1 wherein the cosmetic composition is selected from the group consisting of deodorants, antiperspirants, combination antiperspirant deodorants, shaving products, skin lotions, moisturizers, toners, bath products, cleansing products, hair care products, shampoos, conditioners, mousses, styling gels, hair sprays, hair dyes, hair coloring products, hair bleaches, hair waving products, hair straighteners, manicure products nail polish, nail polish remover, nail creams, nail lotions, cuticle softeners, protective creams, sunscreen, insect repellent, anti-aging products, color cosmetics, lipsticks, foundations, face powders, eye liners, eye shadows, blushes, makeup, mascaras, personal care formulations where silicone components have been conventionally added, and drug delivery systems for topical application of medicinal compositions that are to be applied to the skin.

52. The cosmetic composition of claim 11 wherein the cosmetic composition is selected from the group consisting of deodorants, antiperspirants, combination antiperspirant deodorants, shaving products, skin lotions, moisturizers, toners, bath products, cleansing products, hair care products, shampoos, conditioners, mousses, styling gels, hair sprays, hair dyes, hair coloring products, hair bleaches, hair waving products, hair straighteners, manicure products nail polish, nail polish remover, nail creams, nail lotions, cuticle softeners, protective creams, sunscreen, insect repellent, anti-aging products, color cosmetics, lipsticks, foundations, face powders, eye liners, eye shadows, blushes, makeup, mascaras, personal care formulations where silicone components have been conventionally added, and drug delivery systems for topical application of medicinal compositions that are to be applied to the skin.

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53. The cosmetic composition of claim 21 wherein the cosmetic composition is selected from the group consisting of deodorants, antiperspirants, combination antiperspirant deodorants, shaving products, skin lotions, moisturizers, toners, bath products, cleansing products, hair care products, shampoos, conditioners, mousses, styling gels, hair sprays, hair dyes, hair coloring products, hair bleaches, hair waving products, hair straighteners, manicure products nail polish, nail polish remover, nail creams, nail lotions, cuticle softeners, protective creams, sunscreen, insect repellent, anti-aging products, color cosmetics, lipsticks, foundations, face powders, eye liners, eye shadows, blushes, makeup, mascaras, personal care formulations where silicone components have been conventionally added, and drug delivery systems for topical application of medicinal compositions that are to be applied to the skin.

54. The cosmetic composition of claim 31 wherein the cosmetic composition is selected from the group consisting of deodorants, antiperspirants, combination antiperspirant deodorants, shaving products, skin lotions, moisturizers, toners, bath products, cleansing products, hair care products, shampoos, conditioners, mousses, styling gels, hair sprays, hair dyes, hair coloring products, hair bleaches, hair waving products, hair straighteners, manicure products nail polish, nail polish remover, nail creams, nail lotions, cuticle softeners, protective creams, sunscreen, insect repellent, anti-aging products, color cosmetics, lipsticks, foundations, face powders, eye liners, eye shadows, blushes, makeup, mascaras, personal care formulations where silicone components have been conventionally added, and drug delivery systems for topical application of medicinal compositions that are to be applied to the skin.

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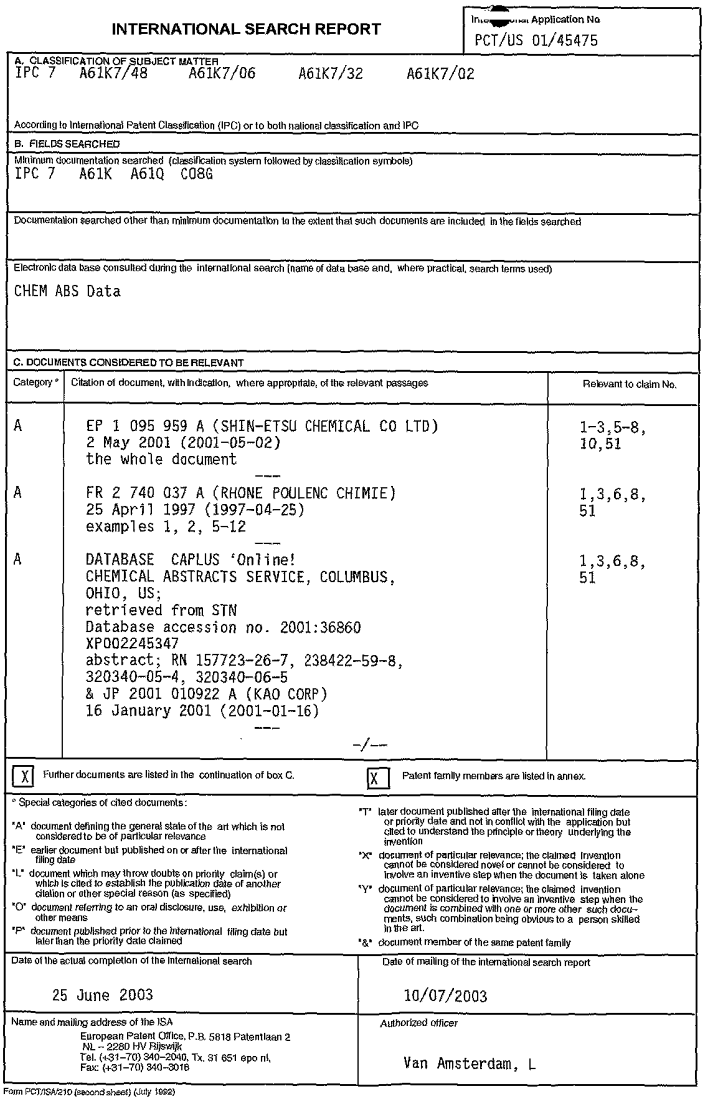
55. The cosmetic composition of claim 41 wherein the cosmetic composition is selected from the group consisting of deodorants, antiperspirants, combination antiperspirant deodorants, shaving products, skin lotions, moisturizers, toners, bath products, cleansing products, hair care products, shampoos, conditioners, mousses, styling gels, hair sprays, hair dyes, hair coloring products, hair bleaches, hair waving products, hair straighteners, manicure products nail polish, nail polish remover, nail creams, nail lotions, cuticle softeners, protective creams, sunscreen, insect repellent, anti-aging products, color cosmetics, lipsticks, foundations, face powders, eye liners, eye shadows, blushes, makeup, mascaras, personal care formulations where silicone components have been conventionally added, and drug delivery systems for topical application of medicinal compositions that are to be applied to the skin.

【国際調査報告】



INTERNATIONAL SEARCH REPORT

International Application No
PCT/US 01/45475

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 A61K7/48 A61K7/06 A61K7/32 A61K7/02

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 A61K A61Q C08G

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

CHEM ABS Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	EP 1 095 959 A (SHIN-ETSU CHEMICAL CO LTD) 2 May 2001 (2001-05-02) the whole document ---	1-3,5-8, 10,51
A	FR 2 740 037 A (RHONE POULENC CHIMIE) 25 April 1997 (1997-04-25) examples 1, 2, 5-12 ---	1,3,6,8, 51
A	DATABASE CAPLUS 'Online! CHEMICAL ABSTRACTS SERVICE, COLUMBUS, OHIO, US; retrieved from STN Database accession no. 2001:36860 XP002245347 abstract; RN 157723-26-7, 238422-59-8, 320340-05-4, 320340-06-5 & JP 2001 010922 A (KAO CORP) 16 January 2001 (2001-01-16) --- -/--	1,3,6,8, 51

☒ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

° Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance
"E" earlier document but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.
"&" document member of the same patent family

Date of the actual completion of the international search
25 June 2003

Date of mailing of the international search report
10/07/2003

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Van Amsterdam, L

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page 1 of 2

INTERNATIONAL SEARCH REPORT

Inte[illegible]nal Application No
PCT/US 01/45475

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication,where appropriate, of the relevant passages	Relevant to claim No.
A	EP 0 574 264 A (GENERAL ELECTRIC CO) 15 December 1993 (1993-12-15) ---	
P,A	EP 1 122 276 A (SHIN-ETSU CHEMICAL CO LTD) 8 August 2001 (2001-08-08) examples; claims 1-21 -----	1-3,5-8, 10,51

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US 01/45475

Box I Observations where certain claims were found unsearchable (Continuation of item 1 of first sheet)

This International Search Report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

2. ☒ Claims Nos.: –
because they relate to parts of the International Application that do not comply with the prescribed requirements to such an extent that no meaningful International Search can be carried out, specifically:
see FURTHER INFORMATION sheet PCT/ISA/210

3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box II Observations where unity of invention is lacking (Continuation of item 2 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

1. ☐ As all required additional search fees were timely paid by the applicant, this International Search Report covers all searchable claims.

2. ☐ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.

3. ☐ As only some of the required additional search fees were timely paid by the applicant, this International Search Report covers only those claims for which fees were paid, specifically claims Nos.:

4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this International Search Report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

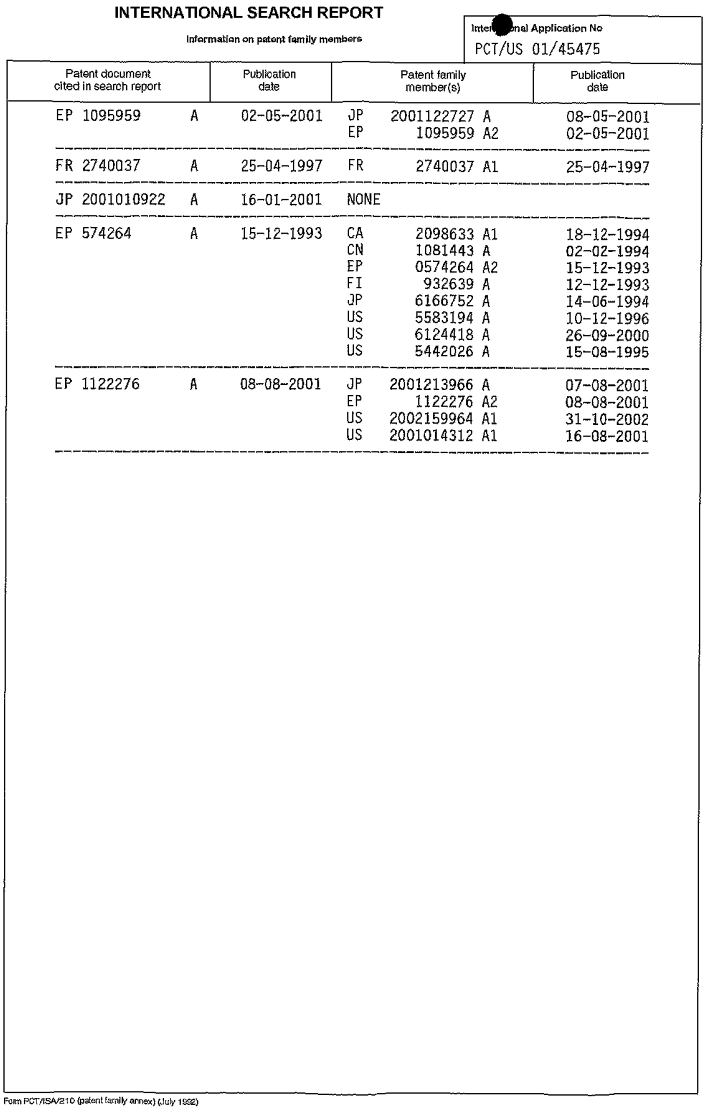
☐ The additional search fees were accompanied by the applicant's protest.
☐ No protest accompanied the payment of additional search fees.

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

Continuation of Box I.2

Present claim 1 relates to an extremely large number of possible products. In fact, the claim contains so many options and variables that a lack of clarity within the meaning of Article 6 PCT arises to such an extent as to render a meaningful search of the claim impossible. Consequently, the search has been guided by those parts of the application which do appear to be sufficiently clear. The search has related to products obtained by further reacting the products of the reaction of silyl hydride bearing molecules of the general formula given on page 4, line 13, of the description and at least one of the epoxides listed in claim 3.

The applicant's attention is drawn to the fact that claims, or parts of claims, relating to inventions in respect of which no international search report has been established need not be the subject of an international preliminary examination (Rule 66.1(e) PCT). The applicant is advised that the EPO policy when acting as an International Preliminary Examining Authority is normally not to carry out a preliminary examination on matter which has not been searched. This is the case irrespective of whether or not the claims are amended following receipt of the search report or during any Chapter II procedure.



INTERNATIONAL SEARCH REPORT

Information on patent family members

Inter[illegible]nal Application No
PCT/US 01/45475

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EP 1095959 A	02-05-2001	JP 2001122727 A	08-05-2001
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FR 2740037 A	25-04-1997	FR 2740037 A1	25-04-1997
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		EP 1122276 A2	08-08-2001
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		US 2001014312 A1	16-08-2001

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フロントページの続き

(51)Int.Cl.^{7}	ＦＩ	テーマコード（参考）
Ａ６１Ｋ　7/32	Ａ６１Ｋ　7/32	
Ａ６１Ｋ　7/48	Ａ６１Ｋ　7/48	

(81)指定国　AP(GH,GM,KE,LS,MW,MZ,SD,SL,SZ,TZ,UG,ZW),EA(AM,AZ,BY,KG,KZ,MD,RU,TJ,TM),EP(AT,BE,CH,CY,DE,DK,ES,FI,FR,GB,GR,IE,IT,LU,MC,NL,PT,SE,TR),OA(BF,BJ,CF,CG,CI,CM,GA,GN,GQ,GW,ML,MR,NE,SN,TD,TG),AE,AG,AL,AM,AT,AU,AZ,BA,BB,BG,BR,BY,BZ,CA,CH,CN,CO,CR,CU,CZ,DE,DK,DM,DZ,EC,EE,ES,FI,GB,GD,GE,GH,GM,HR,HU,ID,IL,IN,IS,JP,KE,KG,KP,KR,KZ,LC,LK,LR,LS,LT,LU,LV,MA,MD,MG,MK,MN,MW,MX,MZ,NO,NZ,OM,PH,PL,PT,RO,RU,SD,SE,SG,SI,SK,SL,TJ,TM,TR,TT,TZ,UA,UG,UZ,VN,YU,ZA,ZW

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Ｆターム(参考)　4C083 AA122 AB032 AB222 AB232 AB242 AB332 AB432 AC012 AC072 AC122
AC172 AC182 AC302 AC342 AC422 AC442 AC692 AC712 AC782 AD072
AD092 AD132 AD152 AD161 AD162 AD282 AD352 AD642 CC01 CC02
CC04 CC05 CC12 CC13 CC17 CC33 CC39 DD05 DD27 DD31
EE06 EE28