FORM 1

COMMONWEALTH OF AUSTRALIA

PATENTS ACT 1952

594500

APPLICATION FOR A STANDARD PATENT

LODGED AT SUB-OFFICE
15 SEP 1987
Melbourne

I\We,

W. L. GORE & ASSOCIATES, INC.

of

555 PAPER MILL ROAD
P.O. BOX 9329
NEWARK
DELAWARE 19714
U.S.A.

hereby apply for the grant of a standard patent for an invention entitled:

RADIATION CURABLE COMPOSITIONS FOR
HYDROPHILIC COATINGS

which is described in the accompanying complete specification

Details of basic application(s):

Number of basic application	Name of Convention country in which basic application was filed	Date of basic application
040955	US	21 APR 87

My/our address for service is care of CLEMENT HACK & CO., Patent Attorneys, 601 St. Kilda Road, Melbourne 3004, Victoria, Australia.

DATED this 15th day of September 1987

W. L. GORE & ASSOCIATES, INC.

CLEMENT HACK & CO.

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TO: The Commissioner of Patents.

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APPLICATION ACCEPTED AND AMENDMENTS

ALLOWED 19-12-89

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CLEMENT HACK & CO.

Australia Patent Declaration Form

Forms 7 and 8

AUSTRALIA

Patents Act 1952

DECLARATION IN SUPPORT OF A CONVENTION OR NON-CONVENTION APPLICATION FOR A PATENT OR PATENT OF ADDITION

Name(s) of Applicant(s)

In support of the application 78397/87 made by
W. L. GORE & ASSOCIATES, INC.

for a patent for an invention entitled
RADIATION CURABLE COMPOSITIONS FOR
HYDROPHILIC COATINGS

PLEASE ADD NAME AND TITLE OF PERSON SIGNING LEGIBLY.

Name(s) and address(es) of person(s) making declaration

I/We, John S. Campbell of W.L. GORE & ASSOCIATES, INC.
555 Paper Mill Road, P.O. Box 9329, Newark, Delaware 19714, U.S.A.

do solemnly and sincerely declare as follows:-

1. I am/we are the applicant(s) for the patent, or am/are authorised by the abovementioned applicant to make this declaration on its behalf.

2. The basic application(s) as defined by Section 141 of the Act was/were made in the following country or countries on the following date(s) by the following applicant(s) namely:-

Country, filing date and name of Applicant(s) for the or each basic application

in United States of America on 21st April, 1987
by Robert L. Henn and Carol H. Morell
in ____ on ____ 19__
by ____

3. The said basic application(s) was/were the first application(s) made in a Convention country in respect of the invention the subject of the application.

Name(s) and address(es) of the or each actual inventor

4. The actual inventor(s) of the said invention is/are
Robert L. HENN, 2126 Coventry Drive, Wilmington, DE 19810, U.S.A. and
Carol H. MORELL, 23 Stuyvesant Drive, Hockessin, DE 19707 U.S.A.

See reverse side of this form for guidance in completing this part

5. The facts upon which the applicant(s) is/are entitled to make this application are as follows:-

The applicant is the assignee of the actual inventors.

DECLARED at Newark, Delaware this 26th day of October 1987

This form may be completed and filed after the filing of a patent application but the form must not be signed until after it has been completely filled in as indicated by the marginal notes. The

(12) PATENT ABRIDGMENT (11) Document No. **AU-B-78397/87**
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(54) Title
RADIATION CURABLE COMPOSITIONS FOR HYDROPHILIC COATINGS

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(56) Prior Art Documents
AU 528107 76689/81 C08G 18/66, C09D 3/80, 3/64

(57) Claim

1. An acrylate-capped polyurethane oligomer comprising the reaction product of:

(a) a polyoxyethylene glycol of molecular weight between 1000 to 2500, present in an amount of between 40% and 75% of said reaction product,

(b) a diisocyanate present in an amount sufficient to provide twice as many molecular equivalents of diisocyanate as molar equivalents of polyoxyethylene glycol, said diisocyanate being selected from the class consisting of 4, 4'-diphenylmethane diisocyanate and 4, 4'-methylene discyclohexyl diisocyanate and

(c) a hydroxyalkyl acrylate present in an amount that results in the oligomer having free-NCO end groups present in an amount between 0.8 and 1.5 weight percent of the total composition weight, and

(d) a reactive diluent.

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Form 10

COMPLETE SPECIFICATION

(ORIGINAL)

FOR OFFICE USE

This document contains the amendments made under Section 49 and is correct for printing.

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TO BE COMPLETED BY APPLICANT

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Complete Specification for the invention entitled:
RADIATION CURABLE COMPOSITIONS FOR
HYDROPHILIC COATINGS

The following statement is a full description of this invention including the best method of performing it known to me:-

FIELD OF THE INVENTION

This invention relates to radiation curable liquid coating compositions which cure to form hydrophilic coatings. These hydrophilic coatings are water transmitting and water absorbing.

BACKGROUND OF THE INVENTION

In general, radiation curable systems are essentially 100% reactive systems, also referred to as 100% solid systems, where substantially all of the components react to produce the final product. Such systems can be cured by exposure to high energy, ionizing radiation or to ultraviolet radiation in the presence of photoinitiators. It is desirable to have coating compositions made from a radiation curable liquid coating composition. And more specifically, it is extremely desirable to have radiation curable, liquid, hydrophilic coating compositions.

Radiation curable liquid coating compositions are well known and many of these involve diacrylate terminated polyurethane oligomers. However, these known compositions are relatively hard and brittle when cured. Furthermore, hydrophilic radiation curable liquid coating compositions are not readily available. Hydrophilic in this patent means a material that is water transmitting and water absorbing. Radiation curable liquid coating compositions having suitable physical properties while maintaining substantial water transmitting and water absorbing characteristics have not been achieved heretofore.

Furthermore, in coating applications, it is usually a requirement to have suitable physical properties to allow for good performance. These applications frequently demand coatings which are pliable. The high crosslink density achieved with radiation curable compositions has usually offered a product of a brittle and hard nature. Concomittant loss of moisture transmitting and water absorbing characteristics is also seen with the higher crosslink density of the prior art composition.

DESCRIPTION OF THE INVENTION

This invention is directed to radiation curable acrylated polyurethanes resulting in a hydrophilic coating having suitable physical properties. These hydrophilic polymers provide for high water transmission and water absorbancy. Furthermore, it is directed to hydrophilic coatings that upon curing have little or no odor that is frequently encountered is acrylated systems. Another aspect of this invention is that it provides soft yet tough radiation curable hydrophilic coatings.

In accordance with this invention, there is provided an acrylate-capped polyurethane oligomer comprising the reaction product of:

(a) a polyoxyethylene glycol of molecular weight between 1000 to 2500, present in an amount of between 40% and 75% of said reaction product,

(b) a diisocyanate present in an amount sufficient to provide twice as many molecular equivalents of diisocyanate as molar equivalents of polyoxyethylene glycol, said diisocyanate being selected from the class consisting of 4, 4'-diphenylmethane diisocyanate and 4, 4'-methylene discyclohexyl diisocyanate and

(c) a hydroxyalkyl acrylate present in an amount that results in the oligomer having free-NCO end groups present in an amount between 0.8 and 1.5 weight percent of the total composition weight, and

(d) a reactive diluent.

Furthermore, the coating composition consists of a reactive diluent which is preferably low odor, such as N-vinyl pyrrolidone, added in an amount less than 20% and, preferably less than or equal to 15%. Where appropriate, a UV photoinitiator package is added to achieve the UV radiation curing. Optionally, a stabilizer may also be added.

The polyurethane oligomers on which the compositions of this invention are based are subject to considerable variations as long as the following parameters are observed. These oligomers must utilize a polyoxyethylene glycol from molecular weight of about 1000 to 2500, preferably about 1500. The final weight of polyoxyethylene glycol in the coating composition must be present in an amount of about 40% to 75% by weight, more preferably 60% to 70% by weight. This is important in order to achieve the desired water transmitting and water absorbing characteristics of the resultant coating. If these glycols are of an inappropriate size, the resultant cured coatings will be of insufficient physical properties or of insufficient hydrophilicity. Second, in order to achieve reasonable physical properties in the final cured coating, there must be an appropriate concentration of reinforcing functional groups in the polymer thus formed.

The diisocyanates useful in this invention have been found to be of the family 4,4'-diphenylmethane diisocyanate and 4,4'-methylenebiscyclohexyldiisocyanate. The ratio of diisocyanate to polyoxyethylene glycol is such that the polyoxyethylene glycol is substantially terminated with the diisocyanate rather than cause chain extension, i.e. that the equivalency ratio is approximately 2:1. This provides for an appropriate balance of physical property enhancement while maintaining a lower viscosity coating composition. Radiation curing is achieved by the reaction of unsaturated groups such as acrylates or methacrylates. The unsaturated groups are introduced onto the prepolymer via a hydroxyalkyl acrylate or methacrylate. The reaction of the hydroxy group and isocyanate from the prepolymer provides for an additional urethane group over that already obtained from the initial reaction of the diisocyanate with the polyoxyethylene glycol. The additional urethane groups from the second reaction further enhance the physical properties. The most preferred hydroxyalkyl acrylate is 1,4-butanediol monoacrylate because of the low odor and flexibility it imparts to the final product. Other hydroxyalkyl acrylates or methacrylates may also be used. The 1,4-butanediol monoacrylate is added at approximately 50% to 75% of the required stoichiometry to partially cap the remaining unreacted isocyanate groups of the prepolymer. The amount added is decided so that it results in an unreacted isocyanate number of less than 1.5%. The preferred method is to add about 75% of the required hydroxyalkyl acrylate stoichiometry so that the unreacted isocyanate number is preferably about 1%.

In addition to the making of urethane acrylate, a reactive diluent is added to further lower the viscosity and to provide for the desired properties of the final product. A preferred reactive diluent is one in which the homopolymer of the diluent has a glass transition temperature higher than the use temperature of the coating composition. The most preferred reactive diluent is N-vinyl pyrrolidone. In order to achieve the desired balance of physical properties and hydrophilicity of the final cured product and in order to achieve a low odor final cured hydrophilic coating, it has been found that the reactive diluent needs to be maintained less than 20% of the entire coating composition, and more preferably, less than or equal to 15%. In order for the coating composition to be curable by ultraviolet light a photoinitiator or photosensitizer package must be added. A number of photoinitiators or photosensitizers would be anticipated to provide for the curing of this designed hydrophilic coating composition. The currently understood preferred photoinitiator is believed to be a eutectic mixture of benzophenone and 1-hydroxycyclohexyl phenyl ketone sold under the trade name of Irgacure® 500 available from Ciba-Geigy, Inc. In addition to the above stated ingredients it may be beneficial in certain instances to provide additional stabilization of the coating composition by adding a thermal stabilizing compound such as phenothiazine.

A number of the objects of this invention are provided for by the dual cure mechanism found by not terminating the polyurethane prepolymer with the complete stoichiometric requirements of the hydroxyalkyl acrylate or methacrylate. It has been found that physical properties are enhanced in the final cured coating by this dual cure route and it has been found that higher water transmitting and absorbing characteristics are also seen. As such, it is important in the practice of this invention not to fully cap all isocyanate groups of the urethane oligomer with the hydroxy monoacrylate stated. If all the isocyanate groups of the urethane oligomers are capped, the product will be too stiff and brittle and will not have sufficient physical properties. It will also be found to suffer in its water transmitting and absorbing characteristics. The acrylate is added to the oligomer at a sufficient level to achieve, at minimum, a gel point upon exposure to ultraviolet radiation via the acrylate curing stage. Subsequent to this gel point and early curing, the isocyanate groups cure via a water reaction, thus forming reinforcing urea groups within the matrix of the polymer and building up the final physical properties. This dual cure path affords a more suitable product both from water transmitting and absorbing characteristics, but more importantly, it is more suitable due to its enhanced physical properties. Some experimentation may be required depending on the starting oligomer used to determine the level of reactive % NCO required for optimizing physical properties and to assure that gel formation occurs via the acrylate functionality employed. It has been seen that the % NCO of the starting oligomer has been preferably found to be around 1% when a polyoxyethylene glycol is used of approximately a molecular weight of 1500. In order to avoid a high crosslink density in the final cured coating, the oligomer of the radiation curable liquid coating composition is terminated such that the sum of the functionality of isocyanate and functionality of acrylate is equal to about 2. The urethane acrylate is thus substantially linear in nature. The coating composition of this invention may be cured by exposure to a diversity of radiation types such as ultraviolet light, beta rays, electron beam and any other actinic radiation.

There are numerous methods of synthesis to produce the required structures of this invention.

The following examples will describe the coating composition of the invention in more detail and describe several examples of uses of the coating composition of this invention. In the following examples, tests were used to characterize several materials. The test procedures were as follows:

MVTR Determination: In the procedure, approximately 70 mls of a saturated salt solution of potassium acetate and distilled water was placed into a 133 mls polypropylene cup, having an inside diameter of 6.5 cm at the mouth. An expanded PTFE membrane, having a Gurley number of about 7 seconds, a bubble point of about 179 kPa, thickness of about 37 microns, and a weight of 20 gms per square meter, available from W. L. Gore and Associates of Newark, Delaware, was heat sealed to the lip of the cup to create a taut, leakproof, microporous barrier containing the salt solution.

A similar expanded PTFE membrane was mounted taut within a 12.5 cm embroidery hoop and floated upon the surface of a water bath. The water bath assembly was controlled at 23°C. plus or minus 0.1°C., utilizing a temperature controlled room and a water circulating bath.

The sample for testing MVTR was cut to approximately a 7.5 cm diameter and was equilibrated in a chamber having a relative humidity of about 86 percent for a minimum of 4 hours. The sample was then placed face down onto the surface of the floating expanded PTFE membrane.

The cup assembly was weighed to the nearest 1/1000 gm and was placed in an inverted manner onto the center of the test sample.

Water transport was provided by the driving force between the water and the saturated salt solution providing water flux by diffusion in that direction. The sample was tested for 15 minutes and the cup assembly was then removed, weighed again to within 1/1000 gm.

The MVTR of the sample was calculated from the weight gain of the cup assembly and was expressed in grams of water per square meter of sample surface area per 24 hours.

A second cup assembly was simultaneously weighed to within 1/1000 gm and placed onto the test sample in an inverted manner as before. The test was repeated until a steady state MVTR was observed by two repetitive MVTR values. With thin hydrophilic coatings (less than 0.25 mm), it generally has been found to require only one test interval to achieve steady state information within the variability of the test.

Gurley Number Determination: Expanded PTFE was tested for Gurley Number, defined in this patent as the time in seconds for 100 cc of air to flow through 6.45 cm^2 of test material under a pressure drop of 1.2 kPa. The test device, a Gurley Densometer Model 4110, was employed in a method similar to Method A of ASTM D726-58. The expanded PTFE was clamped into the testing device with a reinforcing mesh screen (150 microns) under the test sample to prevent rupture of the test sample. Six test samples were employed.

Bubble Point Determination: Expanded PTFE was tested for bubble point, defined in this patent as the pressure required to blow the first bubble of air detectable by its rise through a layer of liquid covering the sample. A test device, similar to the one employed in ASTM F316-80, was used consisting of a filter holder, manifold and pressure gauge (maximum guage pressure of 276 kPa). The filter holder consisted of a base, a locking ring, an o-ring seal, support disk and air inlet. The support disk consisted of a 150 micron mesh screen and a perforated metal plate for rigidity. The effective area of the test sample was 8.0 plus or minus 0.5 cm^2.

The test sample was mounted on the filter holder and wet with anhydrous methanol until clarified. The support screen was then placed on top of the sample and the top half of the filter holder was tightened in place. Approximately 2 cm of anhydrous methanol was poured over the test sample. The pressure on the test sample was then gradually and uniformly increased by the operator until the first steady stream of bubbles through the anhydrous methanol were visible. Random bubbles or bubble stream of the outside edges were ignored. The bubble point was read directly from the pressure gauge.

EXAMPLE 1

A hydrophilic polyurethane-acrylate chemical composition was prepared from 233.4 gms (1.8672 molar equivalents) of 4,4'-diphenylmethane diisocyanate, 682.4 gms (0.9329 molar equivalents) of 1463 molecular weight polyoxyethylene glycol and 101.8 gms (0.7069 molar equivalents) of 1,4-butandediol monoacrylate, using 152.7 gms (15% pbw of formulation) N-vinyl-pyrrolidone as reactive diluent, 0.17 gms (1.7 ppm of formulation) phenothiazine as thermal stabilizer, 30.534 gms (3% parts by weight of formulation), Irgacure® 500 as photoinitiator using the following procedure:

The polyoxyethylene glycol at 80°C was charged into the 1 liter jacketed resin kettle at 80°C and the entire flask was evacuated with vacuum for at least two hours with stirring to degas and remove moisture. The vacuum was then broken and replaced with a dry nitrogen purge. The flaked 4,4'-diphenylmethane diisocyanate was charged into the stirred 80°C reaction vessel. The desired percent isocyanate was generally reached within two hours after the addition of the isocyanate as determined by a standard dibutylamine titration (ASTM D2572-80). The isocyanate terminated polyoxyethylene so obtained was evacuated with vacuum and purged with dry air. With increased stirring the reaction was cooled to 45°C. The N-vinyl pyrrolidone was charged to the reaction at 45°C. An immediate viscosity reduction was observed. Immediately following the N-vinyl pyrrolidone addition the reaction was cooled further to 35°C. The phenothiozine and the 1,4-butanediol monoacrylate were charged into the reaction which was maintained at 35°C for approximately 18 hours. The theoretical percent isocyanate was checked by a standard dibutylamine titration method and was found to be in agreement with the theoretical value. The Irgacure® 500 was blended into the acrylate-capped prepolymer just before discharge into amber, low density polyethylene containers. Storage of these containers at 25-30°C maintained the polyurethane-acrylate in a low, viscosity, liquid form.

EXAMPLE 2

A coated product was made utilizing the coating composition of the present invention and using the apparatus depicted in Figure #1. A roll coater was used in a 0.425 m wide, 4-roll stack configuration, in line with a tenter frame and take-up. The stack comprised of a gravure roll, 1, quadrangular pattern, 33 cells per centimeter, cell depth of 110 microns (33Q/110), nipped at 276 kPa to a Viton® (fluoroelastomer available from duPont) rubber roll, 2, of 90 durometer, nipped at 276 kPa to a chrome roll, 3, nipped at 276 kPa to a silicone roll, 4, of 60 durometer. The gravure roll was heated to 25-30°C; the chrome and the rubber rolls in contact were at 25°C. The gravure roll was in contact with a trough and-doctor blade assembly, 10, containing the polyurethane-acrylate chemistry, 9, of Example 1. The melt viscosity of said chemical substance was approximately 13,000 cps as measured on a rheometer using parallel oscillating discs at the application temperature of 30°C. The chemical substance, 9, transferred from the gravure roll along the stack until coming in contact with a scaffold material, 5. The scaffold material of expanded PTFE was prepared according to the teachings of U. S. Patent No. 3,953,566 and 4,187,390, having a void volume of 87% (as determined by weight, area, PTFE density and measuring thickness by minimal crushing with a spring-loaded micrometer), an overall thickness of ca 18 microns and ca 6 gm/m^2 in weight. The coating (i.e. combination of scaffold and chemical substance), 7, was brought into contact with a nonwoven substrate of a spunbonded polyamide, 10 gms/m^2, at the chrome roll/silicone roll nip. The coated product, 8, thus made travelled from the nip to the tenter frame, passing under two ultraviolet, 118 watt/cm, mercury bulb ultraviolet lamps. The coated product subsequently ambient cured for 48 hours. The final hydrophilic coated product was found to have a moisture vapor transmission rate (MVTR) of 22,841 g/m^2/24 hrs.

EXAMPLE 3

Using the polyurethane-acrylate composition of Example 1, a flexible layered article suitable for use in waterproof garments was prepared according to the teachings of U.S. Patent Number 4,194,041. Upon application of the polyurethane-acrylate chemistry to the expanded PTFE, (characterized by having a void volume of about 70% determined by weight, area, PTFE density and measuring thickness by minimal crushing with a spring-loaded micrometer; an overall thickness of about 25 microns and a weight of about 16.4 gm/m^2), the coating was solidified by passing under two 118 watt/cm, mercury bulb, ultraviolet lamps. Subsequent moisture cure of the coating followed for the next 48 hours. The final flexible layered article was found to have an MVTR of 20,388 $g/m^2/24$ hours. The final coating thickness was approximately 6 microns. This was determined manually from a photomicrograph of a cross-sectional slice of the test sample at 500X magnification and by taking as reference the calibrated bars thereon.

EXAMPLE 4

Solid polymer sheets were prepared from the polyurethane-acrylate composition of Example 1 by pouring said composition onto a silicone treated plate and allowing the coating composition to flow to approximately 2 mm in thickness. The plate along with the polymer composition was then passed under two 118 watt/cm, mercury bulb, ultraviolet lamps, solidifying a majority of the polymer. It was necessary to invert the polymer sheets and provide for an additional exposure to the UV lamps to get complete solidification of the polymer. Subsequent moisture cure of the sheets followed for the next 48 hours. Once cured the polymer sheets were cut into approximately 5 mm by approximately 10 mm pieces to form hydrophilic granules. The granules were submerged in 25°C water until equilibrium was reached where it was found that the hydrophilic granules had absorbed 83% of their own weight of water.

THE CLAIMS DEFINING THE INVENTION ARE AS FOLLOWS:

1. An acrylate-capped polyurethane oligomer comprising the reaction product of:

   (a) a polyoxyethylene glycol of molecular weight between 1000 to 2500, present in an amount of between 40% and 75% of said reaction product,

   (b) a diisocyanate present in an amount sufficient to provide twice as many molecular equivalents of diisocyanate as molar equivalents of polyoxyethylene glycol, said diisocyanate being selected from the class consisting of 4, 4'-diphenylmethane diisocyanate and 4, 4'-methylene discyclohexyl diisocyanate and

   (c) a hydroxyalkyl acrylate present in an amount that results in the oligomer having free-NCO end groups present in an amount between 0.8 and 1.5 weight percent of the total composition weight, and

   (d) a reactive diluent.

2. An oligomer of claim 1 wherein the reactive diluent is less than 20% N-vinyl pyrrolidone.

3. An oligomer of claim 1 wherein the reactive diluent is less than 15% N-vinyl pyrrolidone.

4. An oligomer of any preceding claim further comprising a UV photoinitiator.

5. An oligomer of any preceding claim further comprising a stabilizer.

6. An oligomer of claim 5 wherein the stabilizer is a thermal stabilizer.

7. An oligomer of any preceding claim wherein the diisocyanate is 4,4'-diphenylmethane diisocyanate.

8. An oligomer of any one of claims 1 to 6 wherein the diisocyanate is 4,4'-methylenebiscyclohexyl diisocyanate.

9. An oligomer of any preceding claim wherein the ratio of diisocyanate to polyoxyethylene glycol is about 2:1.

10. An oligomer of any preceding claim wherein the hydroxyalkyl acrylate is 1,4-butanediol monoacrylate.

11. An oligomer of any preceding claim wherein the ratio of diisocyanate to polyoxyethylene glycol to hydroxyalkyl acrylate is 4:2:1.5.

12. An oligomer of any preceding claim wherein the polyoxyethylene glycol is of about 1500 molecular weight.

13. A soft solid hydrophilic material resulting from actinic light and moisture curing of the oligomer of any one of claims 1 to 12.

14. A solid hydrophilic material of claim 13 wherein the reactive diluent is less than 20% N-vinyl pyrrolidone.

15. A solid hydrophilic material of claim 13 or 14 wherein the reactive diluent is less than 15% N-vinyl pyrrolidone.

16. A solid hydrophilic material of any one of claims 13 to 15 further comprising a UV photoinitiator.

17. A solid hydrophilic material of any one of claims 13 to 16 further comprising a stabilizer.

18. A solid hydrophilic material of any one of claims 13 to 17 further comprising a thermal stabilizer.

19. A solid hydrophilic material of any one of claims 13 to 18 wherein the diisocyanate is 4,4′-diphenylmethane diisocyanate.

20. A solid hydrophilic material of any one of claims 13 to 18 wherein the diisocyanate is 4,4′-methylenebiscyclohexyl diisocyanate.

21. A solid hydrophilic material of any one of claims 13 to 20 wherein the ratio of diisocyanate to polyoxyethylene glycol is about 2:1.

22. A solid hydrophilic material of any one of claims 13 to 21 wherein the hydroxyalkyl acrylate is 1,4-butanediol monoacrylate.

23. A solid hydrophilic material of any one of claims 13 to 22 wherein the ratio of diisocyanate to polyoxyethylene glycol to hydroxyalkyl acrylate is 4:2:1.5.

24. A solid hydrophilic material of any one of claims 13 to 23 wherein the polyoxyethylene glycol is of about 1500 molecular weight.

25. An oligomer substantially as hereinbefore described with reference to and as illustrated in the accompanying drawings.

26. A soft solid hydrophilic material substantially as hereinbefore described with reference to and as illustrated in the accompanying drawings.

DATED THIS 12TH DAY OF DECEMBER, 1989
W.L. GORE & ASSOCIATES, INC.
By Its Patent Attorneys:
GRIFFITH HACK & CO.,
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Attorneys of Australia

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FIG. 1