

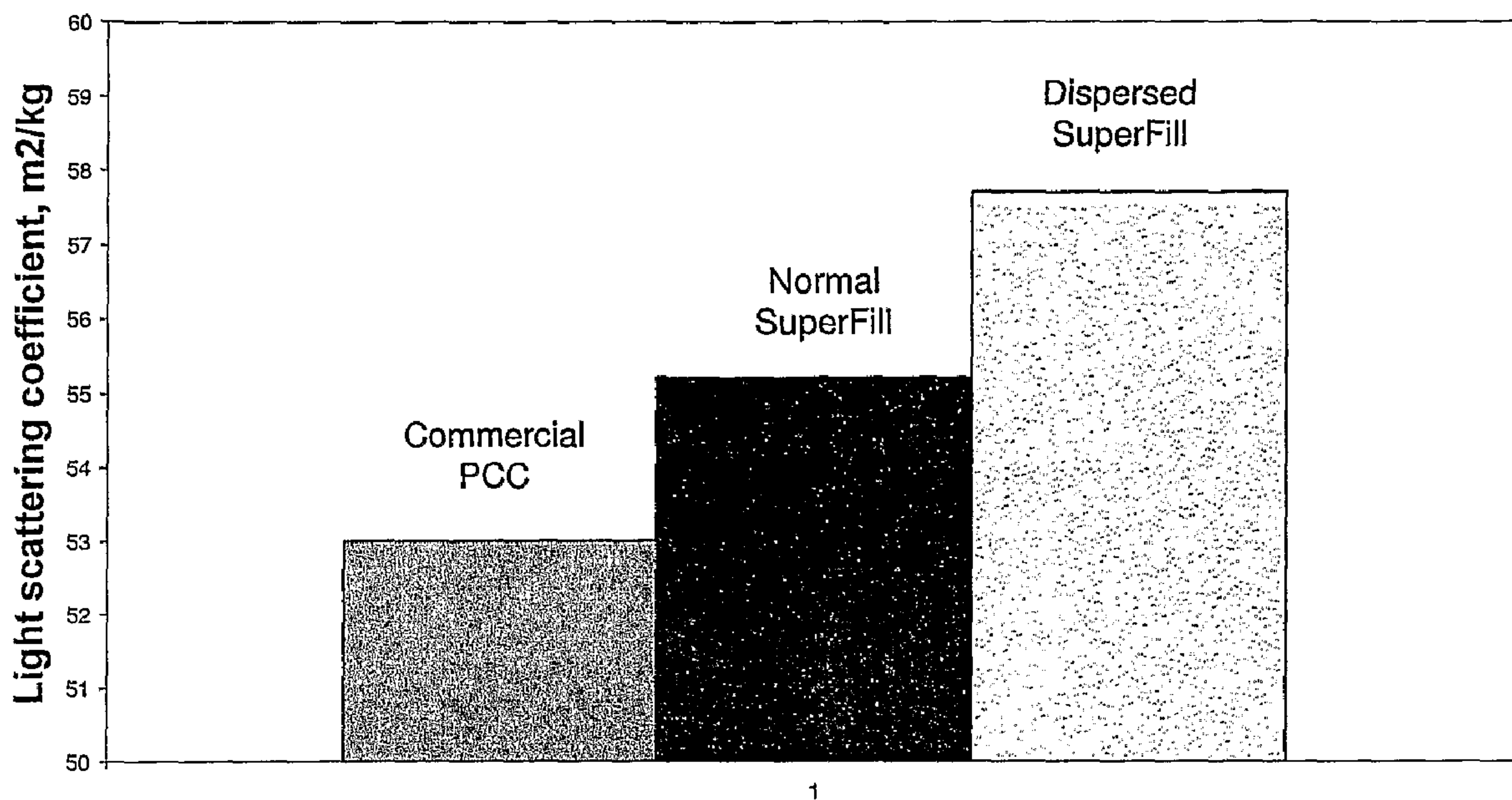


(86) Date de dépôt PCT/PCT Filing Date: 2006/06/21  
(87) Date publication PCT/PCT Publication Date: 2006/12/28  
(45) Date de délivrance/Issue Date: 2014/05/06  
(85) Entrée phase nationale/National Entry: 2007/12/06  
(86) N° demande PCT/PCT Application No.: FI 2006/000222  
(87) N° publication PCT/PCT Publication No.: 2006/136651  
(30) Priorité/Priority: 2005/06/23 (FI20050683)

(51) Cl.Int./Int.Cl. *D21H 17/69* (2006.01),  
*D21H 17/37* (2006.01), *D21H 21/08* (2006.01),  
*D21H 23/04* (2006.01), *D21H 23/76* (2006.01)  
(72) Inventeur/Inventor:  
SILENIUS, PETRI, FI  
(73) Propriétaire/Owner:  
MINTEQ UK LIMITED, GB  
(74) Agent: MACRAE & CO.

(54) Titre : PROCEDE DE PRODUCTION D'UNE BANDE FIBREUSE COMPRENANT UN AGENT DE REMPLISSAGE  
(54) Title: METHOD OF PRODUCING A FIBROUS WEB COMPRISING A FILLER

### Effect of dispersant at low filler levels



#### (57) Abrégé/Abstract:

A method of manufacturing a fibrous web comprising a filler. According to the method, the filler is fed into the fibre slush and a fibrous web is formed of the filler-bearing fibre slush, and this web is dried at the paper or cardboard machine. The filler used is a composite material which comprises cellulose or lignocellulose fibrils, onto which light-scattering material particles have been precipitated. According to the present invention, the filler is brought into contact with the dispersant before it is mixed into the fibre slush. With this solution it is possible to significantly improve the light-scattering properties of papers and cardboards, without decreasing the retention of the filler.

## (12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization  
International Bureau



(43) International Publication Date  
28 December 2006 (28.12.2006)

PCT

(10) International Publication Number  
**WO 2006/136651 A1**

## (51) International Patent Classification:

*D21H 17/69* (2006.01)      *D21H 23/04* (2006.01)  
*D21H 17/37* (2006.01)      *D21H 23/76* (2006.01)  
*D21H 21/08* (2006.01)

## (21) International Application Number:

PCT/FI2006/000222

(22) International Filing Date: 21 June 2006 (21.06.2006)

(25) Filing Language: Finnish

(26) Publication Language: English

## (30) Priority Data:

20050683      23 June 2005 (23.06.2005)      FI

(71) Applicant (for all designated States except US): **M-REAL OYJ** [FI/FI]; Revontulentie 6, FI-02100 Espoo (FI).

## (72) Inventor; and

(75) Inventor/Applicant (for US only): **SILENIUS, Petri** [FI/FI]; Raitapurontie 57, FI-08500 Lohja As. (FI).

(74) Agent: **SEPPO LAINE OY**; Itämerenkatu 3 B, FI-00180 Helsinki (FI).

(81) Designated States (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM,

AT, AU, AZ, BA, BB, BG, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LV, LY, MA, MD, MG, MK, MN, MW, MX, MZ, NA, NG, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RS, RU, SC, SD, SE, SG, SK, SL, SM, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States (unless otherwise indicated, for every kind of regional protection available): ARIPO (BW, GH, GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IS, IT, LT, LU, LV, MC, NL, PL, PT, RO, SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

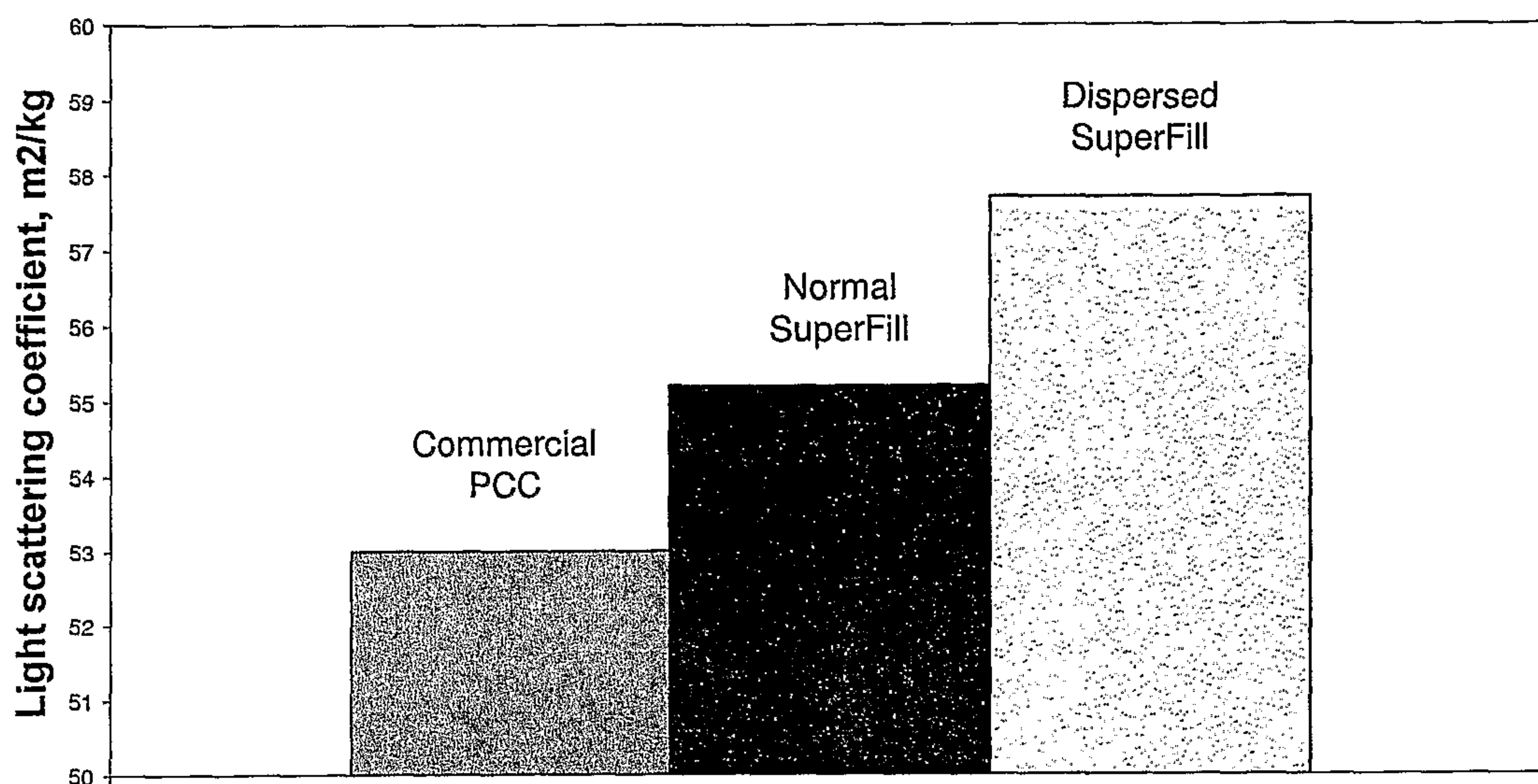
## Published:

- with international search report
- before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(54) Title: METHOD OF PRODUCING A FIBROUS WEB

## Effect of dispersant at low filler levels



(57) Abstract: A method of manufacturing a fibrous web comprising a filler. According to the method, the filler is fed into the fibre slush and a fibrous web is formed of the filler-bearing fibre slush, and this web is dried at the paper or cardboard machine. The filler used is a composite material which comprises cellulose or lignocellulose fibrils, onto which light-scattering material particles have been precipitated. According to the present invention, the filler is brought into contact with the dispersant before it is mixed into the fibre slush. With this solution it is possible to significantly improve the light-scattering properties of papers and cardboards, without decreasing the retention of the filler.

WO 2006/136651 A1

**Method of producing a fibrous web comprising a filler**

The present invention relates to a method of manufacturing a fibrous web including a filler, comprising the steps of bringing the filler into contact with a dispersant to improve the  
5 light-scattering properties of the fibrous web, mixing the filler into a fibre slush, forming the fibrous web from the filler-bearing fibrous slush and drying the fibrous web at a paper or cardboard machine.

In a method such as this, a filler is added to a slush comprising vegetable fibres, after  
10 which the fibre slush forms a fibre web, which is dried at the paper or cardboard machine.

The present invention also relates to use of a dispersant to improve the light-scattering property of a fibrous web, which comprises a filler, which in turn comprises cellulose or lignocellulose fibrils and light-scattering mineral particles which have been precipitated  
15 onto the fibrils, wherein the majority of the dispersant is attached to the filler.

FI Patent Specification 100729 describes a filler which is used in paper-making and which comprises porous aggregates formed of calcium carbonate particles which have been precipitated onto the surface of the fines. According to the patent specification,  
20 characteristic of this new filler is that the calcium carbonate has been precipitated onto fines fibrils which are prepared by a process of refining from cellulose fibres and/or mechanical pulp fibre. The size distribution of the fines fraction is in most cases equivalent to the fraction P100 of the wire screen. In the following, this filler is also called by its product name "SuperFill".

25

On the basis of the said patent specification, the calcium carbonate percentage of the paper can be increased by using the filler, in which case the grammage of the paper can be decreased. In product groups which have a relatively high fresh filler percentage, the presented product gives a considerable advantage.

30

In the context of this invention "Graphic papers" mean types of paper that are used for instance for posters, book-covers, advertisements, maps, illustrated books, and as archival papers. In other words, they are used for purposes where the smoothness, the gloss and the quality of the colour are important properties.

In coated graphic papers, the amount of the pigments in the broke is large, which limits the amount of the fresh filler, among others composite fillers such as SuperFill, too.

Consequently, in these cases it is not possible to fully utilise the ability of, for instance, SuperFill to improve the light-scattering properties of the paper.

5

The purpose of the present invention is to eliminate the disadvantages associated with the known art and to generate a completely new way of producing paper and similar fibre products. In particular, the purpose of the present invention is to generate a method which can be used to produce fibre products possessing good mechanical and graphical

10 properties. Another purpose of the present invention is to generate a solution for increasing the light-scattering coefficient of paper at low fresh filler percentages.

The present invention is based on the idea that the uniformity of the filler distribution is increased by dosing dispersant into the composite filler, in which case the agglomeration of  
15 the calcium carbonate crystals is reduced and thus the light-scattering is increased.

In filler applications, dispersants have earlier been used mainly to improve the pumpability of the filler slurries. The literature mentions that dispersant can be used to increase the uniformity of the filler distribution (Weigl, J. and Ritter, E., "Die Bedeutung der  
20 Teilchengrösse und -form von Füllerstoffen sowie deren Verteilungen bei der SC-Papierherstellung, Wochenblatt für Papierfabrikation, 1995, no 17, pages 739-747.)

The properties of the composite fillers, in turn, have been modified by using several pigments. Accordingly, EP Published Patent Application 0 892 019 describes how  $\text{CaCO}_3$ ,  
25 or another white pigment which turns insoluble, is precipitated onto the fine fibres (fibrils). After that, a further pigment is added in order that the precipitated pigment will bind the second pigment and the fine fibre together, with the result that a composite pigment is generated, one which binds better to paper than does the expensive pigment ( $\text{TiO}_2$ ) by itself.

30

When dispersants are used together with conventional fillers, much of the retentive property of the filler is lost. Unexpectedly, it has now been found that this is not the case when acting according to the present invention. The reason is that a composite filler, such

as SuperFill, can be retained on the paper (or corresponding fibrous web) also when it has been dispersed. In this respect, too, it seems to clearly differ from conventional fillers. Consequently, according to the present invention, a composite filler is used as a filler in papers and cardboards in order to improve the light-scattering properties of the fibrous web. This filler is brought into contact with the dispersant before it is mixed with the fibre slush. More specifically, wherein the filler is a composite material, comprising cellulose or lignocellulose fibrils, onto which light-scattering material particles have been precipitated, wherein the dispersant used is anionic polyacrylate or polyphosphate and wherein the amount of dispersant is 0.05-1.0 weight % of the dry weight of the fibrous web.

10

The use according to the present invention is, in turn, characterized in that anionic polyacrylate or polyphosphate is used as the dispersant and the amount of the dispersant is 0.05-1.0 weight % of the dry weight of the fibrous web.

15 Considerable advantages are achieved with the invention. Thus, the present invention can considerably improve the light-scattering properties of paper and cardboard, without decreasing the retentive properties of the filler. According to the present invention, it is possible to have the filler uniformly distributed in all three directions, whereas using the dispersant in the solution described above (where use of filler in particulate form was  
20 discussed) has mainly led to improvement of the distribution in the z-direction.

The solution presented here gives improved light-scattering properties particularly in those qualities of papers in which the percentage of the filler, particularly the fresh filler, is relatively small. Products of this kind are, among others, the above-mentioned graphic  
25 papers: poster papers, book covers and paper and cardboard used in advertisements, map paper, paper for illustrated books and archival paper.

In the following, the invention will be examined in more detail with the help of the accompanying drawing and a detailed explanation.

30

Figure 1 shows a bar chart of the light-scattering coefficient of papers which comprise three different fillers.

In the method according to the present invention, a fibrous web comprising filler is prepared at for instance a paper or cardboard machine using a method which is known per se. The production is described in more detail below.

- 5 The filler in the fibrous web is a composite material, one which comprises cellulose or lignocellulose fibrils, onto which light-scattering material particles have been precipitated. In order to improve the light-scattering properties of the fibrous web, the filler is brought into contact with the dispersant before it is mixed into the fibre slush. At least most of the dispersant is attached to the material particles of the filler.

10

The amount of the dispersant varies depending on the dispersant and the material particles. In order to determine the upper limit of the addition of the dispersant, in practice it is possible to proceed as follows: a water dispersion of mineral particles (without fibril matrices) is formed, after which dispersant is added to the dispersion. In this way, the  
15 upper limit of the addition of the dispersant is the same amount as that which produces the minimum viscosity of the slurry. Generally, the graph of the viscosity as a function of the dispersant amount is U-shaped, in which case, in the present invention, the amount of dispersant to be added is chosen as an amount which corresponds to the bottom of the U.

- 20 The dispersant used can be conventional anionic polymers, such as anionic polyacrylate – for example anionic sodium polyacrylate, or polyphosphate. Sodium polyacrylates are marketed under the product names Fennodispo<sup>TM</sup> A 40 and A 41 (supplier Kemira Oyj), in which A stands for acrylate and 40 and 41, respectively, indicate the percentage of its aqueous solution. Another corresponding product is Dispex<sup>TM</sup> N40, which is a sodium  
25 polyacrylate, too, and the supplier of which is Ciba Specialty Chemicals. Aminoalcohols can be used as well.

For the above materials, the amounts to be added are approximately 0.05-1 weight % of the dry weight of the fibrous web. Generally, the suitable amount to be added is approximately  
30 0.08-0.5 weight %, especially approximately 0.1-0.35 weight %, most suitably approximately 0.1-0.3 weight %. These limits relate especially to anionic polyacrylate, especially anionic sodium polyacrylate.

4a

The present invention is particularly suitable for fibrous webs which comprise small or average amounts of filler. Typically, the total percentage of the filler is at maximum approximately 25 weight %, especially at maximum approximately 20 weight %, preferably at maximum approximately 15 weight %, of the dry matter of the web. The  
5 minimum percentage is approximately 0.1 weight %. The amount of fresh feed of the filler comprising composite filler is most suitably approximately 0.1-15, preferably approximately 0.5-12 weight %, of the dry matter of the web to be prepared.

The filler used in the present invention is derived especially from the fibrils obtained from the chemical pulp. Here, chemical pulp means a pulp which has been treated with cooking chemicals in order to delignify the cellulose fibres. According to one preferable embodiment, the fibrils have been obtained by refining a pulp which has been prepared using the sulphate process or another alkaline method. The present invention is suitable not only for modifying chemical pulps but also for modifying fibrils obtained from chemi-mechanical and mechanical pulps.

Typically, the average thickness of the cellulose or lignocellulose fibrils is less than 5  $\mu\text{m}$ , generally less than 1  $\mu\text{m}$ . One or both of the following are characteristic of the fibrils:

- a. they correspond to a fraction that penetrates a 50 (or preferably 100) mesh screen; and
- b. their average thickness is 0.01-10  $\mu\text{m}$  (preferably at maximum 5  $\mu\text{m}$ , more preferably at maximum 1  $\mu\text{m}$ ) and their average length is 10-1500  $\mu\text{m}$ .

The initial material of the fibrils, i.e. cellulose or other fibre-based fines, is fibrillated by refining it using a pulp refiner. When needed, the desired fraction can be separated by using a screen, but it is not always necessary to grade the fines. The fractions P50-P400 are suitable fibril fractions. Preferably, refiners having grooved blades are used.

The light-scattering particles of the filler are inorganic or organic salts, which can be formed from their initial materials by precipitation in an aqueous intermediate agent. Such compounds are calcium carbonate, calcium oxalate, calcium sulphate, barium sulphate and mixtures of them. The material particles have been precipitated onto the fibres. The amount of the inorganic salt compound relative to the amount of the fibrils is approximately 0.0001-95 weight %, preferably approximately 0.1-90 weight %, most suitably approximately 60-80 weight %, calculated from the amount of filler and approximately 0.1-80 weight %, preferably approximately 0.5-50 weight % calculated from the paper.

In the following, the present invention is described especially on the basis of the product according to FI Patent Specification 100729. However, it is obvious that the present

invention can be applied to other above-mentioned products by making the necessary changes to the initial materials of the light-scattering pigment.

- The filler is produced by precipitating the mineral pigment onto the surface of the fines  
5 fibrils which are prepared from cellulose fibre and/or mechanical pulp fibre. Precipitation  
of for instance calcium carbonate can be carried out in such a way that an aqueous solution  
of calcium hydroxide, which may comprise solid calcium hydroxide, and a compound  
which comprises carbonate ions and is at least partially dissolved in water, are fed into the  
water slush of fibrils. It is also possible to introduce carbon dioxide gas into the aqueous  
10 phase. In the presence of calcium hydroxide this carbon dioxide generates calcium  
carbonate. Beaded calcium carbonate crystal aggregates are formed, which are kept  
together by the fibrils, i.e. fine filaments, and in which the calcium carbonate particles are  
precipitated and are attached to the filaments of the fines. Together with the calcium  
carbonate the fines filaments form beaded filaments, which mainly resemble pearl  
15 necklaces in a pile. In the water (the slush), the ratio between the effective volume and the  
mass of the aggregates is very large compared with the corresponding ratio of calcium  
carbonate that is used as a conventional filler. The term effective volume here means the  
volume which the pigment requires.
- 20 The diameter of the calcium carbonate particles in the aggregates is approximately 0.1-5  
 $\mu\text{m}$ , typically approximately 0.2-3  $\mu\text{m}$ . The sizes of fibrils correspond especially to the  
fractions P50 (or P100) – P400 of the wire screen. In the filler, at least 80 %, preferably  
even 90 %, of the precipitated light-scattering pigment particles are attached to the fibrils.
- 25 According to the present invention, the volumetric efficiency of the pigment particles is at  
least 60 weight % (of the filler weight), preferably 70 weight % or more, but less than 85  
weight %. Within this range, a good dewatering at the paper or cardboard machine is  
achieved and a constant air permeance in the fibrous web, too.
- 30 The composite filler is modified by means of a dispersant before it is fed to the paper  
machine or cardboard machine. The modification can be done simply by mixing a  
predetermined amount of dispersant with the filler in a mixing tank, wherein the dispersant  
is allowed to be adsorbed or otherwise be attached during mixing to at least the mineral  
particles of the filler. The mixing time is especially approximately 1 minute – 24 hours,

most suitably approximately 5 minutes – 10 hours. The mixing is carried out especially at a relatively high dry matter percentage, which can even be increased due to addition of the dispersant. Typically, the dry matter percentage is approximately 40-80 weight %.

- 5 Besides the mixing tank, continuous mixers can be used, too, in which the mixing of the filler slurry and the dispersant is carried out in pipelines, possibly aided by static mixers inside them.

The bulk of the dispersant that is fed into the filler dispersion, typically at least 80 weight  
10 %, preferably at least 90 weight %, is attached to the filler sufficiently well that it will not be essentially detached from it in the conditions of the headbox. In the headbox, any free dispersant remaining would easily become attached to, for instance, particle-like fillers which might be circulating in the short or the long circulation water coming from the paper or the cardboard machine to the headbox. If a conventional filler is dispersed, the retention  
15 of such a filler decreases significantly.

Consequently, any (part of the) dispersant that remains unattached is preferably circulated back to the elutriation phase of the composite filler in order to attach it as efficiently as possible to the very same filler.

20

The dispersed composite filler is fed and mixed into the fibre slush. In this case, the fibre raw material of the paper or cardboard pulp is first slushed to a suitable consistency in a way which is known per se (typically to a solids percentage of approximately 0.1-1 %). The above-mentioned filler, generally approximately 1-25 weight % of the weight of the  
25 fibres of the fibre pulp, is added into the fibre slush most suitably in the headbox of the paper or cardboard machine. In practice, at least when coated paper and cardboard qualities are being produced, the amount of pigments in the broke is so large that the amount of the fresh feed must be limited to less than 15 weight % of the dry weight of the fibres fed into the headbox.

30

The percentage of the composite filler in the total amount of filler of the web is at least 20 weight %, preferably at least approximately 30 weight %, most suitably at least 40 weight % and especially 50 weight %. More preferably, 75-100 weight % of the filler is composite filler.

At the paper or cardboard machine, the fibre pulp is webbed to form the paper or cardboard web. After that, the web is led from the press section to the drying section, where it is dried in a way which is known per se. The fibrous web is dried and may be coated and optionally  
5 after-treated, for instance by calendering.

It is also possible to produce a multi-layer product which comprises the present filler especially in the surface layers of the product. A multi-layer webbing technique can be used to produce such products. Suitable pulp feeding architectures have been described for  
10 instance in FI Patent Specification 105 118 and EP Published Patent Application 824 157. The multi-layer headbox is used most suitably together with a gap former. In a device such as this, a slice jet formed by the headbox is fed in between two wires and the water is removed from the pulp through the wires in two different directions. Using a gap former, it is possible to make the fines gather on the surfaces of the layer thereby producing an arc-  
15 shaped filler distribution – like the shape of a smile. When the multilayer headbox is used together with the gap former, a desired multilayer structure is generated simply by feeding the paper or cardboard pulp in layers in between the wires by the means described above. This technique can also be used to manufacture products in which the thicknesses of the layers are smaller than when a regular multilayer technique is used.

20

The paper or cardboard product generated according to the present invention can be coated or it can be delivered uncoated.

The coating can be carried out as either a single coating or as a double coating, thus the  
25 coating pastes can be used as single coating pastes and as pre-coating and surface coating pastes. Triple coatings are possible, too. Generally, the coating colour according to the present invention comprises 10-100 parts by weight of at least one pigment or a mixture of pigments, 0.1-30 parts by weight of at least one binder and 1-10 parts by weight of other additives known per se. Examples of such pigments are precipitated calcium carbonate,  
30 ground calcium carbonate, calcium sulphate, calcium oxalate, aluminium silicate, kaolin (hydrous aluminium silicate), aluminium hydroxide, magnesium silicate, talc (hydrous magnesium silicate), titanium dioxide and barium sulphate, and mixtures of them. It is possible to use synthetic pigments, too. Of the pigments mentioned above, the main pigments are kaolin, calcium carbonate, precipitated calcium carbonate and gypsum, which

in general constitute over 50 % of the dry solids in the coating mix. Calcined kaolin, titanium dioxide, satin white, aluminium hydroxide, sodium silicoaluminate and plastic pigments are additional pigments, and their amounts are in general less than 25 % of the dry solids in the mix. Of the special pigments, special-quality kaolins and calcium carbonates, together with barium sulphate and zinc oxide, should be mentioned.

The coating mix can be applied to the material web in a manner known per se. The method according to the present invention for coating paper and/or cardboard can be carried out with a conventional coating apparatus, i.e. by blade coating, or film coating or surface spraying (JET application).

When at least one surface of the paper web is coated, preferably both surfaces, a coating layer is formed, the grammage of which is 5-30 g/m<sup>2</sup>. The uncoated side can be treated for instance with surface sizing.

15

Furthermore, after that the products can be calendered off-line. Naturally, the calendering can be carried out already at the paper machine (on-line).

By means of the present invention it is possible to generate cellulose and lignocellulose-bearing material webs which have excellent printability properties, good smoothness and high opacity and brightness. Here, "cellulose-bearing" material means, in general, paper or cardboard or a corresponding cellulose-bearing material, which is sourced from lignocellulose-bearing raw-material, especially wood or annual or perennial plants. The material in question can be wood-containing or wood-free and it can be prepared from mechanical, chemi-mechanical or chemical pulp. The pulp and the mechanical pulp can be bleached or unbleached. The material can also comprise recycled fibres, especially recycled paper or recycled cardboard. The grammage of the web formed of the material may typically vary between 35 and 500 g/m<sup>2</sup>, especially between approximately 50 and 450 g/m<sup>2</sup>.

30

Generally, the grammage of the base paper is 20-250 g/m<sup>2</sup>, preferably 30-80 g/m<sup>2</sup>. By coating a base paper of this type, which has a grammage of approximately 50-70 g/m<sup>2</sup>, with a 2-20 g coating/m<sup>2</sup>/side and by calendering the paper, a product is generated having a grammage of 50-110 g/m<sup>2</sup>, a brightness of at least 90 % and an opacity of at least 90 %.

The following non-restrictive examples illustrate the present invention. The results of measurements of the paper properties in the examples are determined using the following standard methods:

5

Surface texture: SCAN-P76:95

Air resistance: SCAN-M8, P19

### Example 1

10

The way in which dispersed fillers work to improve the light-scattering coefficients is measured by using a raw-material composition in which the ratio between the hardwood pulp and the softwood pulp is 70/30 (Table 1) and the beating degrees are 22.2 SR (hardwood) and 25.3 SR (softwood).

15

**Table 1**

| Main raw material | Pulp                | Percentage |
|-------------------|---------------------|------------|
| Short stock       | Mixed hardwood pulp | 70 %       |
| Long stock        | Softwood pulp       | 30 %       |

The dispersant dose (as a percentage of the pigments) is determined by measuring the viscosity of the PCC filler slurry as a function of the dose (Table 2). A suitable dose range was obtained from the minimum point of the viscosity. The levels used were 0.10, 0.15 and 0.20 parts of the calcium carbonate.

20

Because the slurry contains very little solid material, the viscosity response does not necessarily show up in this kind of measurements. Therefore, measurements of the concentrated commercial PCC, which has the same crystal structure as SuperFill, were also carried out. It is probable that, using an appropriate accuracy, the best working dose is the same regardless of the composition of the slurry. The materials are mainly adsorbed onto the calcium carbonate, not onto the fines of the paper pulp.

25

The viscosity measurements were carried out using spindle no. 2, by spinning at 100 rpm for 15 seconds, in order to prevent the SuperFill from sedimenting.

30

**Table 2**

|    |                               | Levels | Temperature<br>°C | BF (m Pas) |
|----|-------------------------------|--------|-------------------|------------|
| 5  | Superfill without dispersant  | -      | 20                | ~ 130      |
|    | SuperFill with A 40           | 0.10   | 20                | ~ 124      |
|    | "                             | 0.15   | 20                | ~ 117      |
| 10 | "                             | 0.20   | 20                | ~ 110      |
|    | Albacar LO without dispersant | -      | 20                | ~ 131      |
|    | Albacar with A 40             | 0.10   | 20                | ~ 39       |
| 15 | "                             | 0.15   | 20                | ~ 26       |
|    | "                             | 0.20   | 20                | ~ 27       |

The dose selected was 0.2 parts (of calcium carbonate) of dispersant (Kemira's Fennodispo  
20 A40), which is added to the SuperFill filler.

**Example 2**

When measuring the light-scattering coefficient (Table 3), an adequate dispersant dose was  
25 used. PAC and an anionic polyacrylamide for PCC were used as retention agents. The  
amounts of retention agents used were always kept to the minimum.

**Table 3**

| Test no.                      | 44                          | Sheet<br>no. | 1    | 2    | 3    | 4    | 5    | 6    | 7    | 8    |
|-------------------------------|-----------------------------|--------------|------|------|------|------|------|------|------|------|
| <b>DOSE</b>                   | <b>chemical/sheet</b>       |              |      |      |      |      |      |      |      |      |
| Starch of the<br>raw-material | C*BOND 35845                | %            | 0.50 | 0.50 | 0.50 | 0.50 | 0.50 | 0.50 | 0.50 | 0.50 |
| Filler 1                      | ALBACAR LO                  | "            | 10.0 | 20.0 |      |      |      |      |      |      |
| Filler 2                      | SUPERFILL Ref.              | "            |      |      | 10.0 | 20.0 |      |      |      |      |
| Filler 3                      | SUPERFILL with A40          | "            |      |      |      |      | 10.0 | 20.0 |      |      |
|                               | PAC 18                      | "            | 0.25 | 0.25 | 0.25 | 0.25 | 0.25 | 0.25 | 0.25 | 0.25 |
| Retention agent               | PERCOL HC 4000<br>(anionic) | "            | 0.04 | 0.04 | 0.02 | 0.02 | 0.02 | 0.02 | 0.02 | 0.02 |

30 The following adjustments were used during the measuring (Table 4).

**Table 4**

| <b>ADJUST-<br/>MENT results</b> | <b>Sheet<br/>no.</b> | <b>1</b> | <b>2</b> | <b>3</b> | <b>4</b> | <b>5</b> | <b>6</b> | <b>7</b> | <b>8</b> |
|---------------------------------|----------------------|----------|----------|----------|----------|----------|----------|----------|----------|
| Formette drum speed             | r/min                | 1250     | }        |          |          |          |          |          |          |
| Raw-material pump               | bar                  | 3.20     |          |          |          |          |          |          |          |
| Cylinder drier speed            | m/min                | 1.50     |          |          |          |          |          |          |          |
| pressure                        | bar                  | 1.50     |          |          |          |          |          |          |          |
| temperature                     | °C                   | 100      |          |          |          |          |          |          |          |
| drying time                     | min                  | 5.0      |          |          |          |          |          |          |          |
| Grammage product control        | g/m <sup>2</sup>     | 79.8     | 81.5     | 79.8     | 79.4     | 79.5     | 81.1     | 78.9     | 77.9     |
| Filler contents                 | %                    | 10.7     | 20.1     | 10.1     | 20.2     | 10.5     | 20.7     | 10.4     | 19.7     |

5 The advantages achieved with the present invention are shown in the accompanying drawing. In Figure 1, the light-scattering coefficients of paper are interpolated to the same tensile index level (39 Nm/g) for dispersed SuperFill, for the same SuperFill without dispersion, and for the commercial PCC (Albacar LO), which has the corresponding particle size distribution.

10

The filler level was approximately 11 %, and the ratio between the hardwood pulp and the softwood pulp is, as mentioned above, 70/30, and the beating degrees SR 22.2 (hardwood) and 25.3 (softwood).

15 As the figure shows, the dispersion of SuperFill substantially improves the light-scattering coefficient compared with the same SuperFill filler which is not dispersed. The effect of the dispersion is significant, especially at low or middle range percentages of filler.

Further analyses were carried out on the products and it was found that the other properties  
20 of the papers (density, strength, opacity and brightness) had remained good, regardless of the changed conditions.

**Claims:**

1. A method of manufacturing a fibrous web including a filler, comprising steps in the order of:

- 5       a) bringing the filler into contact with a dispersant to improve the light-scattering properties of the fibrous web, wherein greater than 50% of the dispersant is attached to the filler;
- b) mixing the filler comprising the attached dispersant into a fibre slush;
- c) forming the fibrous web from the filler-bearing fibrous slush; and
- 10       d) drying the fibrous web at a paper or cardboard machine;
- wherein the filler is a composite material, comprising cellulose or lignocellulose fibrils, onto which light-scattering material particles have been precipitated;
- wherein the dispersant used is anionic polyacrylate or polyphosphate; and
- wherein the amount of dispersant is 0.05-1.0 weight % of the dry weight of the
- 15       fibrous web.

2. The method according to Claim 1, characterized in that the amount of the dispersant is 0.05-0.3 weight % of the dry weight of the fibrous web.

20       3. A method according to Claim 1 or 2, characterized in that the filler percentage of the fibrous web is at maximum 15 weight % of the dry weight of the web.

         4. A method according to any one of Claims 1 to 3, characterized in that the cellulose or lignocellulose fibrils are prepared from vegetable fibres by refining and screening, and the

25       thickness of the cellulose or lignocellulose fibrils is less than 5  $\mu\text{m}$ .

         5. The method according to Claim 4, characterized in that the light-scattering material particles have been precipitated onto said fibrils, the size of which corresponds to a fraction which penetrates a 50 mesh screen, and/or the average thickness of which is 0.1-10

30        $\mu\text{m}$  and the average length 10-1500  $\mu\text{m}$ .

6. The method according to Claim 4 or 5, characterized in that the light-scattering material particles are an inorganic salt compound which can be generated from their initial materials by precipitation in an aqueous intermediate agent.

5     7. The method according to Claim 6, characterized in that the inorganic salt compound is selected from the group consisting of calcium carbonate, calcium oxalate, calcium sulphate and barium sulphate.

8. A method according to Claim 6 or 7, characterized in that the percentage of the  
10     inorganic salt compound of the filler weight is 75-85 weight %.

9. Use of a dispersant on a precipitated filler to improve the light-scattering property of a fibrous web, wherein said precipitated filler comprises light-scattering mineral particles which have been precipitated onto cellulose or lignocellulose fibrils, and wherein greater  
15     than 50% of the dispersant is attached to the filler, characterized in that anionic polyacrylate or polyphosphate is used as the dispersant, and the amount of the dispersant is 0.05-1.0 weight % of the dry weight of the fibrous web.

10. The use according to Claim 9, characterized in that the amount of the dispersant is  
20     0.05-0.3 weight % of the dry weight of the fibrous web.

11. Use according to Claim 9 or 10, characterized in that the filler percentage of the fibrous web is at maximum 15 weight % of the dry weight of the web.

1/1

Effect of dispersant at low filler levels

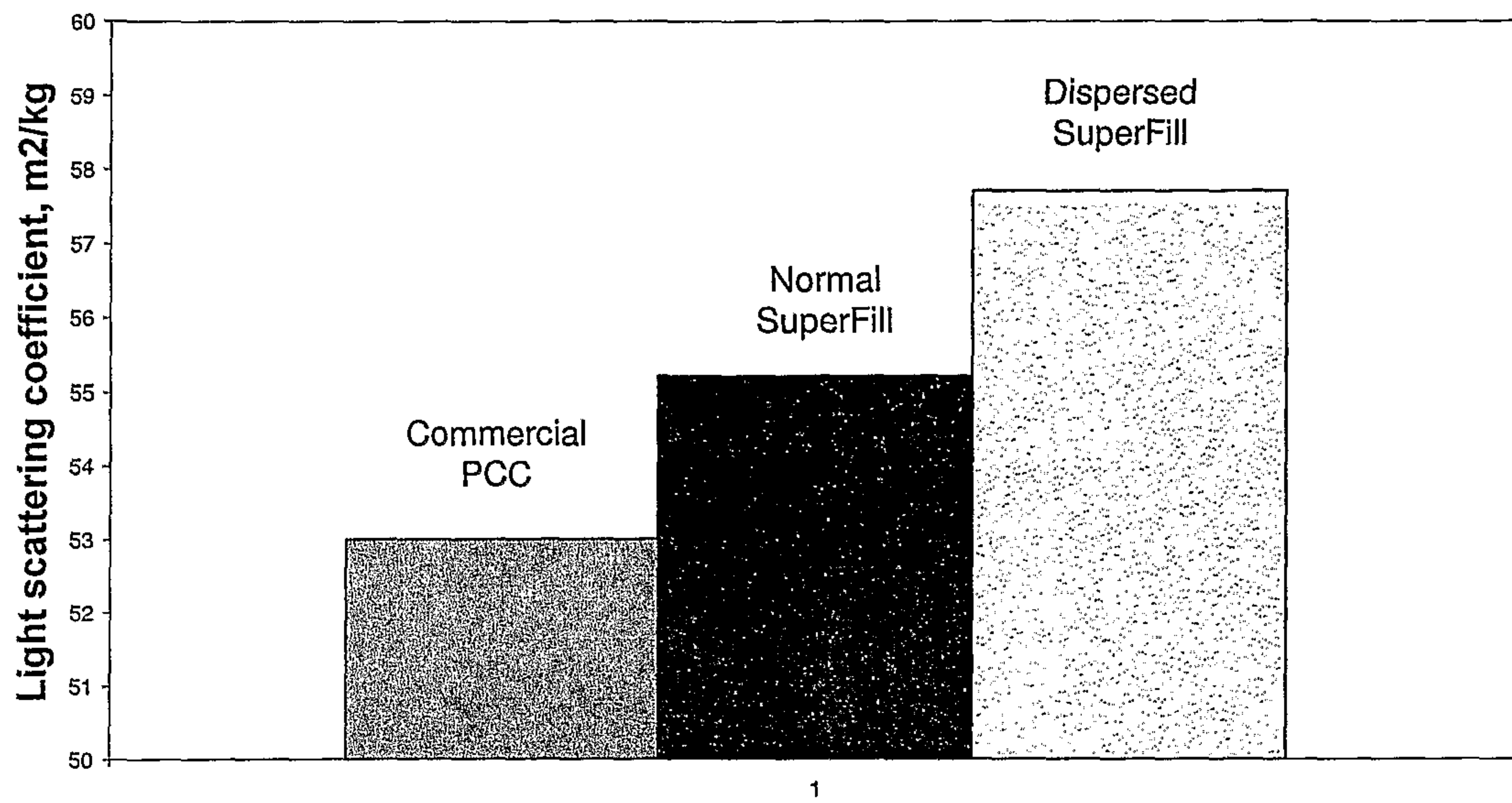


Fig. 1

## Effect of dispersant at low filler levels

