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(54) Title: A NEW PROCESS FOR RESTORING THE FLOWABILITY OF A PIGMENT-CONTAINING CEMENT OR CONCRETE COMPOSITION, NEW FILLER AND PIGMENT COMPOSITION, NEW FILLER AND RESTORATION FILLER COMPOSITION, NEW USE OF A FINE FILLER AS FLOWABILITY RESTORATION FILLER

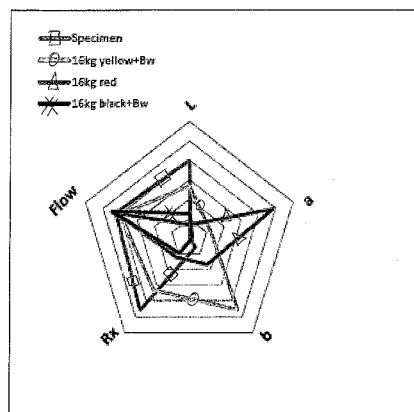


Fig 6

(57) Abstract: Process for restoring the « performance » of a cement slurry based on white or grey cement, containing at least one flowability-degrading pigment, in which a fine filler such as a fine GCC is used to recover up to 90 to 100 % of the flowability. The process incorporates the possibility to evaluate the color quality such as L, a, b, (and R xyz factors) (diagram Fig. 6), L being evaluated at about 85 days. The flowability is restored by the fine GCC, alone or in combination with the filler of the base cement composition, and the fine GCC can be combined as ready-for use premixes with either the base filler or the considered pigment.



A new process for restoring the flowability of a pigment-containing cement or concrete composition, new filler and pigment composition, new filler and restoration filler composition, new use of a fine filler as flowability restoration filler.

TECHNICAL FIELD

The technical field is that of « cement formulations ».

A « base » cement formulation, in the present application, as is known to the skilled man, is a formulation comprising:

- at least one hydraulic binder
- at least one fine aggregate
- water or a water-based mixing fluid for the cement formulation
- optionally a filler like preferably a calcium carbonate
- possibly rheology etc..., routine, additives

Special additives such as (color) pigments, colorants and dyes, hereafter « pigments », can be added when needed.

Cement comes in various shades and is then named « white » or « grey ».

White and grey cements are subject to precise standards which are known to the skilled man.

The present technical field is more specifically that of « **base** » cement formulations based on:

- a white or grey cement

- fine aggregates, namely sand,
- at least one color pigment,
- water or water-based fluid, preferably water,
- a « base » filler like preferably.

5

The base filler can be, not limitatively, a calcium carbonate.

The present invention is based on a cement base composition comprising:

- a white or grey cement
- 10 - fine aggregates, namely sand,
- at least one color pigment,
- water or water-based fluid, preferably water,
- a base filler.

- 15 The present invention also cover **concrete compositions**, that is a base cement composition to which, as is well known, gravel is added in a known manner.

In the present application, « cement formulations » or « cement compositions » *will include concrete compositions*, with the only difference that gravel is present. The
20 technical problem, in the presence of pigments, is the same, and the solution of the present invention solves the technical problem in the same manner.

TECHNICAL PROBLEM

25

In WO 2013/128268, WO 2013/128271 and WO 2013/128270, the Applicant has developed specially cement formulations and tests methods with the purpose of

helping the skilled man to formulate cement compositions even in quite difficult situations, that is namely when the flowability of the formulation is severely impaired by the nature and properties of the hydraulic binder and/or of the filler. In such conditions, the formulation is too « thick » or too viscous (that is, very poor flowability) to be used
5 by the end-user's skilled man.

The above cited documents describe and define the well known « cone test » commonly used to appreciate « flowability » (or almost equivalently « consistency ») of a cement formulation, and define three techniques for upgrading a « low » performing
10 filler (leading to a poor consistency in a cement formulation) into a « medium » performing or even a high performing (HP or high quality) filler leading to a formulation with a correct or excellent consistency/flowability for the end-user.

This previous work however does not address the quite different problem
15 appearing when formulating a color cement composition, that comprises at least one pigment (pigment, colorant or dye).

The skilled man knows that a pigment is a fine to very fine product, which features a high tendency to absorb water, sometimes in even significant amounts.

20

In a cement formulation, when water is absorbed, the delicate balance between the binder, the water, the filler and the aggregate (and optionally gravel in a concrete formulation) is altered, or severely altered, and the technical « performance » of the cement formulation decreases.

25 The technical problem is too, as importantly, to allow the skilled man to use the amount of pigment he wishes, so as to reach the proper color density, and to use whatever pigment he wishes, even the pigments provoking the worst problems.

« **Performance** » within the meaning of the present invention refers here to a set of
30 properties, namely rheological properties, like flowability or consistency or fluidity, all features well known to the skilled man, and the like, that allow the end user to use the

- formulation with no problems other than minor adjustments to his specific need and to his specific starting materials. In such a context, not only will a pigment damage such set of properties, namely by reducing the flowability/consistency of the cement formulation (what is often referred to as a fluidity decrease or a « poor consistency » of the cement formulation and translates into a reduced diameter in the « cone test ») such as described in WO 2013/128268, WO 2013/128271 or WO 2013/128270, but the pigment will also be prevented to impart the correct color to the cement formulation.
- 10 The desired color tone, hue or saturation will not be reached or achieved, at least not accurately, or not with a proper color density or color intensity, or not in a reproducible manner from one batch to the next one, and the skilled man, , can do nothing but to add water to try and compensate the water loss caused by the water uptake of the pigment as previously mentioned, and try that way to re-establish the good
- 15 performance of the final cement formulation. The skilled man may also be prevented to incorporate the desired amount of color pigment, due to a too heavy degradation of the flowability of the final cement formulation, and is therefore prevented from reaching the desired color intensity or tone or density etc... Adding water in such way is obviously a tenuous trial and error process, expensive and time consuming, and
- 20 inaccurate as to its result. And in addition it can not solve all the situations.

Additionally, such additions of water may provoke a loss in mechanical strength of the final cement product, this generating a risk of incompatibility with the cement (point of saturation and secondary effects, i.e. impact on the setting time, color tone, hue or saturation, crack and impact resistance etc...).

The technical problem thus to be solved by the present invention is to « restore » the performance of a colored cement formulation whose performance is degraded due to the presence of a pigment, that is to improve the performance *criterii*, namely fluidity or consistency or flowability (which properties are used almost equivalently by the skilled man) and desired color tone, hue or density so that the performance of the pigment-containing cement formulation features a good consistency or fluidity or flowability, identical or very close to that of the considered cement composition, had it not

contained the deleterial pigment. A secondary technical problem, which is the direct consequence of the above, and therefore is part of the global « technical problem » is too, as importantly, to allow the skilled man to use the amount of pigment he wishes, so as to reach the proper color density, and to use whatever pigment he wishes, even
5 the pigments provoking the worst problems.

It is therefore an object of the present invention to provide :

- **A a Process for improving the « performance »** (that is for « restoring » the
10 good performance of a cement formulation in the presence of a pigment, without being forced to proceed to tenuous trial and error tests such as adding water) of a cement slurry based on white or grey cement, a « base » filler, namely but not limitatively a « base » calcium carbonate, at least one pigment, water or a water-based mixing fluid, and sand, and optionally
15 routine additives such as rheology additives, anti-foam additives, etc...) characterized by the use of the below described « Restoration Filler » which belongs to a specific class of fine fillers, namely carbonates, namely calcium carbonates, in admixture with the « base » carbonate filler.

20 An important point being that, by restoring the performance of the cement formulation, the said process allows the pigment to be selected and used so as to produce the correct color, that is the desired color tone with the desired intensity or color density).

25 If a concrete formulation is contemplated, gravel is incorporated in known proportions and manner. This will not be repeated uselessly in the following.

- **B the corresponding Cement Formulations** comprising a white or grey
30 cement, the at least one pigment, water or water-based mixing fluid, as well as

- the **combination** of the « base » filler and of the inventive « Restoring filler » as described below,

- **C** the corresponding **New Use of a specific class of fine restoring fillers** namely but not limitatively carbonates, namely calcium carbonates which will be described below as « Restoration carbonate Filler » to improve or « restore » the flowability / consistency and the color quality of a base white-cement formulation containing a pigment
- 10 - **D New Restoration Filler Blend** as a new industrial product for cement formulations characterized in that it comprises a blend of at least a « base » filler and at least one « restoration » fine filler namely but not limitatively carbonates, namely calcium carbonates filler(s) selected from the above « specific class », namely fine GCC, in a ratio of between 5/95% to 95/5 by weight, preferably 30/70 to 70/30, pref.
- 15 40/60 to 60/40, preferably 50/50.

A premix base filler / rest. filler (Betocarb™ / Betoflow™) can be seen at from 256 / 1 by weight to 228 / 8 by weight in Table 11.

- 20 - **E New Restoration Filler / Pigment Blend** as a new industrial product, characterized in that it comprises at least a pigment capable of degrading the flowability of a cement composition and at least a « restoration filler » as defined above, in a ratio of pigment / restoration filler from 1/1 to 5 / 1, by weight.

Usable pigment-restoration filler premixes can be at a ratio by weight of: pigment 3 /

25 rest. filler 1, see Table 11.

- **F a Pigment Damage / color Evaluation Process** for determining easily which pigments will degrade the performance of a cement formulation, and which will not, so that the skilled man has a tool for deciding when to proceed with the
- 30 implementation of the above restoration process and the corresponding above cement

formulation or use of the carbonate restoring filler or restoring filler blend or restoration filler / pigment blend.

Definitions or conventions

5

Except if otherwise mentioned, a **singular includes a plural**. As an example, « one filler » include blends of several fillers of the considered classes ; same for « a cement » ; same for « a pigment », etc...

10 **Performance:** see above

Pigment means here (in the whole application and claims) only one pigment, or a mixture of several pigments, known to impart a given color to cement formulations.

15 Usual requirements for pigments for use in colored mortar and concrete formulation are for the pigment to be weather resistant, chemically inert, alkali resistant, light fast (UV resistant), and water resistant. Pigments can be characterized usually with indicators such as grading, process, purity, oil & water absorption levels, opacity, coloration power, content in water soluble salts, etc.... The skilled man may refer to
20 Standards ASTM C 979 or EN 12878.

It is generally admitted that pigment have a fineness which can be down to 40 microns, that is a particle size which may be from 2 or 5 microns up to 40 microns ref. « Houillères de Cruéjols » « Pigments » « Mode d'emploi », established 15/09/2009.

25 That document contains the AFNOR definition of pigments, and the list of expected properties and impacts on mixtures.

Each pigment has a particular « flowability » and « brightness » signature. This is known to the skilled man and means that each pigment is known to have a distinct

impact on flowability (appreciated by the cone test) and brightness or luminance factor L (defined below) in the considered colored cement formulation.

Water means here mixing water or mixing water-containing or water-based mixing fluid
5 for the cement formulation. Water may contain known routine additives.

« Base » cement formulation means here a formulation for cementing, building, construction etc... applications, comprising:

- a cement binder,
- 10 - one fine aggregate namely sand
- optionally but much preferably a « base » filler
- at least one color pigment,
- and water,
- *optionally gravel if this is a « concrete » formulation*
- 15 - plus possibly one or more routine additives such as rheology adjusting additives, defoaming agents, etc... even though those are not mentioned,

which cement formulation leads to a dual consistency and color technical problem as described hereabove, due to the presence of the pigment, and more specifically the
20 said base cement formulation having a flowability decreased by a maximum of 10 % or about compared to the same composition not comprising the color pigment, wherein the flowability is determined by the cone test method.

It is obviously possible to use blends or combinations of cement binders, blends of fine
25 aggregates, namely blends of sands, blends of base fillers, blends of color pigments, since as mentioned above "singular" means "plural" in the present application and claims, except as specifically otherwise clearly mentioned

« **Reference** » **cement formulation** means the above « base » cement formulation without the color pigment, colorant or dye.

Sand means one (or a blend) of the usual fine sand used as an aggregate for cement formulations, namely siliceous sands belonging to the scope of Standard EN 196-1
5 esp. Art. 5.1, and described in the above cited EPAs.

In the below specification, Tables and claims, **SAN 099** is such a siliceous sand.

The sand SAN099 is a siliceous sand according to standard EN 196-1.

10 **Fine calcium carbonate** means here a calcium carbonate with the following main features:

0.5 micron < d50 < 5 microns

Preferably 1 micron < d50 < 3 microns

15 85 % < CaCO₃ content < 100 %

pref 90 % < CaCO₃ content < 98 % by weight

The **Restoration carbonate filler** as described below belongs to that class of « fine calcium carbonates » as defined hereabove. It can be, as will be described below, a
20 GCC (ground calcium carbonate, or « natural ») or a PCC (precipitated calcium carbonate), most preferably a fine GCC such as a ground marble, chalk or limestone.

A fine GCC can be defined as 90-95-100 % passing 63 microns sieve and d50 < 5 microns plus a CaCO₃ content of at least 85 pref. at least 90 % weight CaCO₃.

25

Representative examples of fine GCCs feature:

d50 of 2.8 or 4.3 or 4.0 or 4.8 or 2.8 or 3.0 with respective Blaine surface (EN 196-6) of (m²/kg) 1018 or 1135 or 942 or 937 or 1022 or 1102, respectively.

A preferred restoration filler is commercialized under the name Betoflow™ D d50 3 microns CaCO₃ 98.6 % w 100% passing 63 microns sieve Methylene blue test 0.33 g/kg.

5 Betoflow™D can be advantageously used in combination with pozzolanic filler products.

The skilled man will be able to select different fine carbonate fillers of the same class, in view of the above, as a replacement for Betoflow D or in admixture with it.

Betoflow™ F can be used in that class as being very close to Betoflow D properties.

10

A « **base** » filler is a filler such as a calcium carbonate which is present in the « base » cement formulation. It is known to be used to promote the compactness of cement based products.

15 Base fillers can be selected in the present invention among carbonates, calcium carbonates, metakaolin, kaolin, dolomie, fly ashes, « laitiers de ciment », aluminosiliceous fillers, and organo-siliceous fillers, and their blends known to the skilled man.

A higher compactness enhances the brightness of the cement by increasing the efficiency of the pigment.

20

For improving the compactness, carbonates such as Betocarb™ HP, Betocarb F, or Betoflow D are quite efficient. All names are TMs of the Applicant or affiliates.

25 The **performance** of a cement slurry is known to be appreciated by a set of properties mainly related to rheology, a crucial one being « flowability » or « consistency ».

The **flowability** is the capacity for a cement formulation to flow, and it obviously correlates with the almost equivalent properties of « fluidity », or « consistency ».

To « **improve** » the **consistency** also correlates with a decrease in viscosity, what correlates to an increase in fluidity and an increase or improvement in flowability.

Flowability/consistency/fluidity can be appreciated by the well-known « cone test » and
5 more precisely the « mini-cône test » as described with great details in the above EPAs

A very simple test is routinely used to classify the systems, using a “mini cône à chape” known as “self-levelling test” or “screed flow cone test”.

10 The test is well known and is conducted as follows, according to the recognized **Standard EN 196 - 1**; the said standard defines accurately the mixer or kneading (also malaxing) device to be used, the speed of rotation, and each and every such data useful for reproducing the test. Therefore, no more explanations or definitions are needed here for the sake of clarity or reproducibility.

15

Self Levelling Test or Cone Test:

Basically, a cement or mortar or concrete “system” is prepared by mixing the above ingredients according to usual practice, recalled here-below in more detail though the process conditions are well known, then is poured in accordance with the above
20 Standard conditions, into an inverted cone which is perforated at its bottom (dimensions are also given by the said Standard as well as each and every useful data of the test).

The cement or mortar or concrete system therefore flows into and out of the said cone, namely through its bottom aperture, and falls onto an horizontal plate to form a “chape”
25 (“screed”).

It there forms a “galette” or “cone spread” also known as “dry to plastic or fluid form” which “spreads” and whose diameter is measured, **and** whose aspect is separately visually inspected for example for stickiness and “thickness”, and “flow speed”, etc.... ; the latter property when “thick” or sticky” or “pasty” or “low flow” reflecting a “slow” or
30 “viscous” mix, that is, especially if “thick”, or worst “dry”, hard to handle. To the

contrary, a high flow speed and a fluid aspect corresponds to a nicely workable product, of the "FLUID" type.

The larger the diameter, the more flowable the system. For a given high consistency, as targeted by the invention, this is the major test.

- 5 Given the quality of the initial filler to be used in the concrete system, namely its place of production, morphology etc. the resulting cone will vary in diameter, this indicating a variation in flowability. Attention has also to be paid to the "cone" used, which plays a role in the obtained diameter. All this is abundantly known to the skilled man.

- 10 As an example, a GCC which is known to use no or almost no mixing water, and shows such valuable properties, will lead to a very fluid, non sticky cement or concrete composition. Such a composition will be fully usable for "**technical**" (that is, "high performance" or "**HP**") concrete compositions, called "FLUID" above.

- 15 If to the contrary, the filler namely GCC filler absorbs or uses a noticeable amount of water, or contains some impurities, etc. the resulting composition will be less fluid and become to be somewhat sticky. The end user will be forced *inter alia* to either add a corrective adjuvant (with an associated extra cost and an associated risk of secondary effect of the composition as a whole) and / or add extra water (thus being detrimental to consistency and inducing associated risks). Those compositions will be used for medium quality compositions, called "PLASTIC" hereabove.

- 20 At the other end of the ladder, using a filler namely a GCC of poor quality will lead to a composition which will exit the mixer under the form of sticky granulates. Those will be used only for DRY concrete compositions, NOT part of the invention.

The test will be sufficient for a skilled man to rate the starting GCC and / or PCC (s).

The same is valid *mutatis mutandis* when using a PCC or a GCC/PCC blend.

25

The skilled man will know that the above wordings are used almost synonymously in order to characterize the flowability or even more generally the performance of a cement formulation.

« **Routine additive** » : among such routinely used additives are
« **Superplasticizers** » : a superplasticizer as defined in the cited EPA s can be used to finely adjust the flowability.

- 5 They are selected among polycarbonates, polycarboxylates, polycarboxylate-ethers, iminisulfonates, or much less preferred products manufactured from sulfonated naphthalene condensate or sulfonated melamine formaldehyde. The skilled man knows these products.
- 10 A preferred family will be polycarboxylates.

In the below examples, CHE100 is a polycarboxylate.

- CHE 100 can be advantageously the product sold under the designation CHRYSO TM
- 15 Fluid Premia 196.

Besides polycarboxylates can also be used polycarboxylate-ethers, iminosulfonates, polycarbonates.

- 20 « **White cement** » is a class of cement well-known to the skilled man, and means here a non colored cement, that is having a natural white color, known to the skilled man, such as a « Chalk Portland Cement » or « Ciment Portland au Calcaire » according to Standard EN 197 – 1, such as ref. CEM II/A-LL 42,5 R.

- Such a well known product is commercialized by Compagnie des Ciments Belges,
- 25 CCB, Gaurain, Belgique.

In the examples, **CEM 113** is a white cement from LafargeTM under the designation CEM I 52,5 N CE CP2 NF blanc (« white »).

« Grey cement »

A grey cement is a class of cement equally well known to the skilled man, and ref. can be found in the Standard EN 197 – 1.

5 Usable cements are, with no limitation, belonging to Standards

CEM II/A-LL 42.5 N CE CP2 NF

CEM I 52.5 N CE CP2 NF

CEM I 52.5 N CE CP2 NF

Such cements are produced by Lafarge TM

10

Usable cements correspond too to the NF EN 196-1, Method for testing cements, AFNOR.

DESCRIPTION OF THE INVENTION

15 In the present invention, it is possible and preferable to use a naturally good or « high quality » carbonate filler, though it is also possible to use a « low » or « medium » filler due to the possible addition of the superplastifier, here CHE 100 polycarboxylate in the examples.

As an example, BetacarbTM can be used in place of BetacarbTM HP (high quality)

20 Definitions of high quality, medium and low can be found in the above cited EPAs.

DRY systems (**poor** quality or **“low”**) (casting is performed with high vibration and energy).

PLASTIC systems (**medium** quality) (medium vibration and energy).

25 (The two above categories may also be named **“standard”** by the skilled man).

FLUID systems (**High performance** or **“HP”**) (low vibration and low energy).

(The “fluid” or “HP” systems are also named “technical grade” by the skilled man)

Process for Improving the Performance of a white-cement formulation containing a pigment

It is assumed here that the pigment belongs to those which degrade the performance
5 of a good-performing cement formulation.

As explained in great detail in the above cited EPAs, the Applicant has developed the concept of « deblocking » a « blocked » cement formulation, thus restoring the good performance, and further efforts in R&D have led to the following. This is the function
10 of the superplastifier here when a medium or low base filler is used in the « base » cement formulation. Which is not the preferred solution.

When a high quality base filler is used, like Betacarb HP , the superplastifier such as the polycarboxylate referenced CHE100 in the examples plays only a function of finely
15 adjusting the rheology as may be wished by the end-user.

The present **process** of the invention **for improving the « performance »**, namely the fluidity or consistency or flowability of a « base » white-or-grey cement composition comprising of white or grey cement, optionally but much preferably a base filler, and /
20 or of the sand (and / or of any further particulate ingredient, particulate solid ingredient), a pigment, and water, is characterized in that it comprises replacing a portion of the « base » filler (if any) and/ or of the sand (and / or of any further particulate ingredient, particulate solid ingredient) with an effective amount of a fine « restoration » calcium carbonate .

25

An “efficient” or “effective” amount of a fine restoration calcium carbonate will be the amount or proportion able to restore the flowability of the colored cement formulation to that of the none colored cement composition, being reminded that usually the color pigment degrades the flowability by 5 % to a maximum of 10% or about 10%. This will
30 help the skilled man to define the “efficient” amount of restoration calcium carbonate.

A The said **fine restoration calcium carbonate filler** pertains to the class of fine calcium carbonates characterized by

0.5 micron < d50 < 5 microns

Preferably 1 micron < d50 < 3 microns

5 90 % < CaCO₃ content < 100

The calcium carbonate used as « restoration calcium carbonate filler » is a fine GCC (ground calcium carbonate, or « natural ») such as a ground marble or limestone.

10 The preferred product in this class is a product commercialized by the Applicant under the trade name **Betoflow D** [™] which is the best mode and preferred fine GCC carbonate in this class is a product featuring :

15 d50 3 microns CaCO₃ 98.6 % w 100% passing 63 microns sieve Methylene blue test 0.33 g/kg.

Other restoration carbonate fillers in this class of fine GCCs are products featuring :

90-95-100 % passing 63 microns sieve

d50 < 5 microns

20 CaCO₃ content of at least 85 pref. at least 90 % weight CaCO₃ .

Representative examples of fine GCCs feature:

d50 of 2.8 or 4.3 or 4.0 or 4.8 or 2.8 or 3.0 with respective Blaine surface (EN 196-6) of (m²/kg) 1018 or 1135 or 942 or 937 or 1022 or 1102, respectively.

25

The restoration calcium carbonate is a PCC (precipitated calcium carbonate).

The said restoration PCC that can be used in the present invention feature about the same properties (d50, Blaine) as the above GCC.

5 The said « restoration » fine calcium carbonate filler is incorporated in a proportion of from 0.1 % up to 5 % by the total weight of the whole cement formulation.

The said « restoration » fine calcium carbonate filler is incorporated in a proportion of from 0.5 % up to 3 % by the total weight of the whole cement formulation .

10 The said « restoration » fine calcium carbonate filler is incorporated in a proportion of from 0.5 % up to 2 % by the total weight of the whole cement formulation.

Representative examples of such percentage will be find in the following tables and examples.

15

B Base filler : The base cement formulation may contain NO base filler, that is, in the best mode here, no Betacarb HP.

20 This depends on the type and amounts of the other ingredients, and of their impact on compactness, flowability and mechanical strength, or even color. When, in particular, compactness and mechanical properties are in the correct ranges, the base filler may be omitted.

This will be part of the base knowledge of the skilled man, with a possible help from a few trial and error tests, maybe just one test to check if a base filler is need or not.

25 Most generally, a base filler is needed.

However, formulations of this invention with no base filler cannot be ruled out.

The **base fillers** can be selected among carbonates, calcium carbonates, metakaolin, kaolin, dolomie, fly ashes, « laitiers de ciment », organo- and alumino-siliceous fillers, and their blends known to the skilled man.

- 5 A preferred base filler is a GCC calcium carbonate filler featuring the following properties:

D50 5 to 20 microns (Betocarb TM HP)

preferably 1 to 5 microns Betocarb TM F)

Passing 63 microns sieve > 70 %

- 10 pref. 100 %

Passing 125 > 85 %

pref. 100%

Passing 2 mm 100 % (both)

Blaine surface > 220 m² / kg

- 15 pref. > 900 m² / kg

Basically, the Betocarb TM family is well known to the skilled man, and is a natural product GCC with a high purity and « cleanliness » with :

- 20 $\text{CaCO}_3 + \text{MgCO}_3 > 90 \%$ with $\text{CaCO}_3 > 65\%$ pref. $\text{CaCO}_3 > 95 \%$

Methylene blue test < 10 g / kg

- 25 A preferred base filler is made of a blend the above base filler with an **alumino-siliceous or organo-siliceous** filler.

In the present application, “**aluminosiliceous material**” is a product or blend of products mainly made of siliceous product(s) and/or aluminous product(s). “**Mainly**” means that the said products may contain only a minor amount of non aluminosiliceous products, such as impurities etc..., as a result of the industrial
5 production, as is well known from the skilled man.

Such products are preferably selected among aluminium oxides such as various forms of Al_2O_3 , silica fumes (SF) such as various forms of SiO_2 or SiO_2 fumes, calcined kaolin or “metakaolin” (MK), pozzolanic products (used by cement industry) such as blast furnace slags (see **EN – 197 – 1**), ultrafine siliceous products from the industry
10 etc., and preferably blends of globally speaking Al_2O_3/SiO_2 .

Non limitative examples are:

- Sifraco™ C800 containing 98% SiO_2 and a minor amount (0.71%) of Al_2O_3 , and traces of CaO and MgO (this is an illustration of the above wording “mainly”); SSP
15 = 7.49 (surface measurement since the fineness is too high for a Blaine measurement) ; d50 (median diameter) = 1.86 micron

- Condensil™ S95 D which is a silica fume obtained while preparing **silicium** d50= 1.2 micron Blaine > 1600 m^2/kg BET (specific surface area measured using nitrogen and BET method according to ISO 9277) BET = 16 m^2/g .

20 - Pieri™ (Grace™) Premix MK : this product is a metakaolin of d50 = 3 microns Blaine : too fine BET = 3.8 m^2/g

- Hauri™ Phonolit d50 = 14 microns BET = 6.12 m^2/g .

As mentioned above, **singular** means plural too and we remind here that blends of
25 base fillers can be used along with the general knowledge of the skilled man.

C The color pigment is added at a dosage of 0 – 40 kg/m^3 , pref. 1 to 5 to 15 – 35 kg/m^3 of the whole cement formulation, and an equivalent amount of a solid material ___ such as cement and/or sand (and/or gravel if a concrete) is removed from the
30 « reference cement formulation ».

As will be shown in the examples, usual values are in the range of 10 to 35 kg/ m³, and specific values of interest are 16 and 32 kg/m³ by weight of the whole cement formulation.

- 5 The best mode as of today, for the pigments tested, is 16 kg/m³.

Another way to describe the proportion of pigments is a weight pigment to cement ratio from 0 to 15 %, in particular 1 %.

- 10 Evidently, the % of pigment depends in some respect on the nature of the pigment and of the color intensity which needs to be reached.

- 15 The above value of 0 % (no pigment) has to be understood to be used in a cement formulation, white or grey, or having some inherent poor coloration, such as some inherent yellow parasite coloration, where the formulations of the invention can help to correct that parasite coloration.

In most if not all the situations, the pigment % will not be zero, but can be as low as 0.1 % or 2, 5 % depending on the need of the final end user, obviously.

20

D A **superplasticizer** is used as « Additive » in a proportion from 0 to 3 % by weight of cement . It is a « routine » additive.

Such plasticizers (or superplastifiers) are described in the above EPAs.

25

They are chosen in the following families :

- polycarbonates
- polycarboxylates

- polycarboxylate-ethers
- iminosulfonates.

A preferred product, as used in the examples, is a polycarboxylate sold under the trade
5 name Premium 196 CHRYSO TM.

The above list and the above example are preferred ones, but not limitative.

This is done in order, after the flowability is restored by the fine restoration filler, to
10 finely adjust the flowability.

The flowability, in the present invention, is preferably restored to cone test values of
320 to 400 mm.

15 The preparation of the cement or concrete formulation is performed in a manner
known to the skilled man, by the mere, usual, mixing of the component.

Cement formulations

20 The invention also relates to the **Cement formulations** comprising a white or grey
cement, water, sand, most preferably a base filler, a pigment and a restoration
carbonate filler and characterized in that it was prepared with the components and by
the process according to the above and namely contains an efficient amount of the
restoration filler so as to restore the flowability up to cone values of above 320 mm,
25 preferably equal to or above 360 mm.

In the considered cement formulations containing a color pigment and in which the
impact of the pigment on the flowability is corrected with an efficient amount (as

expressed above) of a restoration filler also as described above, all the ingredients and proportions are as described above in relation with the « restoration process ».

The flowability, in the present invention, is preferably restored to cone test values of 320 to 400 mm. Flowability is regarded as good to excellent from values above 360
5 mm.

Restoration is regarded as reached when the flowability of the pigment-colored cement formulation is restored to between about 90 % and 100 % of the initial (that is with no pigment) flowability.

10 Cement formulations containing a white or grey cement, water, sand, a base carbonate filler are characterized in that they contain from 2 % to 20 % by weight of a fine carbonate filler as flowability restoration carbonate filler, in combination with the base carbonate filler.

15 They contain preferably from 5 to 15 % of fine restoration filler.

The examples will show more specific, but non limitative, values. Evidently, the % of restoration filler to be added will depend on how negative the impact of a considered
20 pigment is on the flowability.

The invention also cover cement formulations as to above characterized in that the said fine restoration carbonate filler shows the features as above under A/ , B / C / D.

25 Cement formulations as to above are characterized in that they contain a superplasticizer namely belonging to the polycarboxylate, polycarbonate, polyvarboxylate-ethers, iminosuflonates family.

The superplasticizer is present in a proportion of 0 to 5 % by weight of the cement, most preferably from 0 to 2, most preferably from 0 to 0.5 % by weight of the cement.

The best mode as of today is about 0.4 % by weight of the cement.

A process for preparing a cement base composition the process comprising the steps of :

- 5 a) providing at least one cement;
- b) providing at least one fine aggregate;
- c) providing water or water-based fluid;
- d) providing at least one filler; and
- e) providing at least one of a pigment, colorant or dye or a combination thereof,
- 10 f) mixing the components provided in the steps a) to e) for a time sufficient to obtain a homogenous mixture;

wherein the flowability of the mixture obtained in step f) is decreased by a maximum of 10 % compared to a mixture obtained by mixing of all components provided in the steps a) to d) for a time sufficient to obtain a homogenous mixture; the flowability
15 being determined by the cone test method.

The invention also relates to the **New Use of a fine calcium carbonate** as defined above as a flowability restoration additive in cement compositions comprising a white cement, sand, water, a « base » carbonate, and a pigment.

20

The invention also covers the new and inventive **New Filler PreMix** for cement compositions comprising a white cement, sand, water, a « base » carbonate, and a pigment, characterized in that it consist of a **blend** of the « base » carbonate and of the « flowability restoration additive » in a ratio of between 5/95 % to 95/5by weight,
25 preferably 30/70 to 70/30, pref. 40/60 to 60/40 , preferably 50/50.

A premix base filler – rest. filler can be seen at from 256 / 1 by weight to 228 / 8 by weight in Table 11.

Such new filler premix can therefore be used as a single mix filler able to ensure the compactness, mechanical strength etc... and to simultaneously restore the flowability of the pigment-containing cement formulation.

- 5 The ratios will be defined so as to provide a range of ready-to-use mix filler, a ratio corresponding to the restoration of a given level of flowability damage. This will prevent the end user to have the mix done by himself.

The ratios can be easily defined and adjusted from the below examples.

10

The invention also covers the **New use of a New filler Premix** for cement compositions comprising a white cement, sand, water, a « base » carbonate, and a pigment, consisting of a **blend** of the « base » carbonate and of the « flowability restoration additive » in a ratio of between 5/95 % to 95/5 by weight, preferably 30/70
15 to 70/30, pref. 40/60 to 60/40 , preferably 50/50, for the restoration of the flowability and the improvement of the color of a colored cement formulation.

The use of the said new filler premix is done at the dosages in each base filler and restoration filler ingredient as individually defined hereabove.

20

The invention also covers a new and inventive **Color Pigment PreMix** for cement formulations characterized in that it comprises a blend of a color pigment with a restoration filler.

- 25 The premix can be made in a ratio of pigment / restoration filler from 1/1 to 5 / 1, by weight.

Usable pigment-restoration filler premixes can be at a ratio by weight of : pigment 3 / rest. filler 1, see Table 11.

Such premixes offer the technical advantage to provide pigments under a « flowability-corrected » form, that is a pigment which , when added as such a premix in a base cement formulation as above, at the usual % of pigment, does NOT impair the flowability of the cement formulation.

5

The invention also cover the New use of the said Color Pigment PreMix to correct or annihilate the negative impact of the pigment on the flowability and color quality of the cement composition.

- 10 The use of the said Color Pigment PreMix is done at the dosages in each pigment and restoration filler ingredient as individually defined hereabove.

The invention further covers a **Color Evaluation and Pigment Correction Process**.

- 15 The following examples will show that the above process for restoring the flowability of the cement formulation, as well as the new use of a restoration filler, and the new blends as described, allow to correct the negative impact of a color pigment on the flowability of a cement formulation.

- 20 The values in the tables and the corresponding Notes will show that optimum values exist, which may depend on the pigment.

- The Color Evaluation and Pigment Correction Process, to be implemented on a « base » cement formulation containing a color pigment, is characterized in that an efficient amount of restoration filler is added to the cement formulation, based on the type and nature of the pigment, and on the fillers type, until the flowability is restored to the value corresponding to a cement formulation with no pigment.
- 25

- Practically, the restoration is performed when the pigment and restoration filler are dosed in such a way – to be taken or deduced from the examples and Tables below –
- 30

that the diameter of the « disque » in the cone test is above 320, preferably above 360 mm.

The said Process is also characterized in that the luminance index L of the pigment -
5 containing cement formulation is evaluated after a period of time which is about 80 to 85 days after the formulation has been prepared.

Surprisingly, the examples below show that, in the presence of a pigment, the
flowability values and above all the L index are not stable before the said period of
10 time, and this is independent of the various systems considered, and namely of the pigment type and of the fillers type, what is also surprising.

The below examples, Tables and Figures will also show that, with the use of the
present invention, it is possible for the en user to incorporate more pigment than can
15 be done usually, since the invention restores the flowability so that the loss of water problem no longer exists, what in turn allows the end user to reach a higher color density of intensity than in the prior art.

EXAMPLES

20

EXAMPLE 1

« Reference » cement formulation or « specimen »

To implement that process, a « reference » cement formulation is prepared by mixing:

- 25
- a white or grey Portland cement as described above (CBB reference, here CEM 113 in the Tables) 415 kg
 - a siliceous sand as described above, ref. SAN 99 above 1350 kg
 - mixing water 230 kg

- a calcium carbonate Betocarb HP used in an optimized amount of 260 kg.

This is a « base » formulation as above but not containing a pigment.

- 5 As may be necessary, a superplasticizer as indicated above may be added so as to finely adjust the flowability.

Evaluation of the color of the « specimen » (reference cement ; with NO pigment) as a function of the dosage in « base carbonate filler ».

10

- Table 1 A** shows (samples P25 to P29) the weight composition of various such reference formulations (with no pigments and no « restoration carbonate filler » see column « fine GCC » empty) when using five different amounts of the base filler which is here Betocarb HP™ (this is the fine calcium carbonate « base » filler as discussed
15 above) whose particle size distribution curve (PSD) is represented on Figure 7.

LG1 tests are tests performed in the mini - cone test as described in the above EPAs.

- 20 The given result expresses the diameter of the product (diameter of the spread « disque » or « galette » in mm) when the mass of cement formulation spread on the reception plate after freely flowing through the cone.

As is known, the higher the diameter of the « disque », the higher the flowability (and viscosity) and the better the consistency.

- 25 CHE100 is a superplastifier as described above and in the cited EPAs, sold under the designation of Premium 196 CHRYSO™.

CEM 113 is the above described Lafarge Portland white cement.

SAN099 is the above describe siliceous sand.

Vfunnel test is an appreciation of the viscosity by measuring the time for a specific amount to entirely flow through the standardized funnel.

Evidently, the higher the time, the higher the viscosity and, see LG1 tests, the worst the consistency.

In the whole present application and claims, we use the $L^*a^*b^*$ Model known as CIE Lab, colorimetric model from Commission Internationale de l'Eclairage (1976) : it is based on the XYZ Model.

10

L factor relates to « luminance », from black =0 to white =100.

a factor represents a range of 600 levels on a red axis (+299 positive values) to grey = 0 then to green (-300 negative values)

b factor represents a range of 600 levels on a yellow axis (+299 positive values) to grey = 0 then to blue (-300 negative values).

L, a, and b factors are often referenced as L^* , a^* , b^* for differentiation purposes. In this application, the factors are used equivalently with or without the « * ».

20 Ref. ISO PR NF EN ISO 11664-4

Hunter Lab Model

Robert Sève Science de la couleur, Aspects physises et perceptifs, Marseille, Chalagam, 2009, p 139-146.

25 **Table 1 B** shows for the said samples the L (luminance) a (red index) b (yellow index) Rx Ry Rz (color evaluation indexes) after 10 days, 31 days and 97 days.

It has been surprisingly discovered that it is necessary to wait for such a long time as about 85 days (about 80 – 88 days) before the color be fully stabilized.

The results of Table 1 B are presented visually on **Figures 1 A, 1B and 1C**.

5

Figure 1 A and 1B show a peak in flow test (flowability/cone) for an optimal amount of Betocarb HP, corresponding to a better compactness and better mechanical strength of the final cement product, and a good L value, which also corresponds to a low point in b value (Figure 1C).

10

It is possible by varying the amount of base filler, here Betocarb HP, to adjust the inherent yellow color of the cement to a low point, that is improve the color of the reference cement formulation.

15 A low yellow index b means that the formulation is as white as possible.

A maximum value in Flow and L are obtained at about the same filler dosage than the low b index value.

20 The three figures that it is possible to adjust finely the filler dosage and obtain simultaneously a low yellow index, and a high flowability and a high brightness.

This test also demonstrates that the carbonate filler allows to optimize the whiteness, the brightness and the flowability (consistency) of a cement formulation, even with no pigment, by adjusting the % carbonate filler and/or % sand (optimization method : « LG System » TM).

25

In a second step, pigment behaviour is studied.

Evaluation of the yellow color (pigment) at a dosage of 3.9 % / weight cement vs. time and vs. base filler content

Table 2 A shows samples P20 to P24 respectively identical to above P25 to P29 as to the reference cement formulation but containing in addition 3.9 % (by weight of the cement) (16 g) of a yellow pigment as defined above.

Properties are shown in **Table 2 B** at 10, 31, 107 days and about 4 months later (XXX days see dates).

10 This represents

- the « **base** » cement formulation,
- *that is the « reference » cement formulation*
 - o *additionally containing a yellow (« jaune ») pigment*
 - o *but containing **no** « restoration carbonate filler » (see empty column « fine GCC »).*

FIL099 is calcium carbonate Betocarb™ HP whose particle size distribution curve (PSD) is represented on Figure 7.

CEM113 is the above described CCB cement, namely CEMI 52 5N CP2.

20 SAN099 is the above described siliceous sand, namely CEN Sand EN 196-1

Table 2 C represent the Delta Base values for the samples studied in Tables 2A and 2B.

25 **Figures 2A and 2B** show the L* enhancement and the a* enhancement at 10 and 30 days as a function of the dosage in base carbonate filler, here Betocarb HP™ which is a « premium GCC » that is a high quality GCC.

These figures show that, in the same formulation as in table 1A, but with 16 g or yellow pigment, there exists again an optimum value for the yellow index b .

5 Study of the yellow pigment – variation of the dosage in pigment and evaluation of the color vs. time

A yellow pigment is used at various dosages as shown in **Table 3 A**.

There is no « restoration carbonate filler ».

10 The base filler dosage varies to compensate the addition of pigment, so that the total weight of the « base » cement formulation remains the same.

LG1 tests and Vfunnel tests are as described above.

Table 3B shows the L , a , b , R_x , R_y , R_z after 15 days and 85 days.

15 **Table 3 C** show the evaluation of L , a , b , R_x , and « Flow » (that is, diameter (mm) of the « disque », that is of the flown mass when spread in a receiving Petri dish, at 15 days).

20 A second measurement (not shown) at 85 days confirms that the time for stabilizing the flow and L values is about 85 days, though in this examples the values at 15 and 85 days are close.

25 In this Table, and all corresponding Tables, one evaluates the minimum value, the maximum value, and the « delta » (that is the difference mini-maxi) for each considered property.

The specimen contains no pigment. Two samples contain respectively 16 and 32 g of yellow pigment.

Figure 3 is a diagram showing visually the « Flow/L/a/b/Rx » domains of respectively the « specimen » (« base » cement formulation with no pigment), and of the P4 (3.9 % yellow pigment/cement) and P5 (7.7 % yellow pigment/cement) samples of Tables 3A and 3B.

5

This diagram, and all corresponding diagrams in these examples, are read the following way :

From the center (zero point) of the « pentagon » start 5 axes towards a high value of, respectively, flowability F or Flow, L (brightness), red index a, yellow index b, and mechanical property special index Rx.

The values increase from the center zero to each outside end of each axis.

15 One can see that the specimen (no pigment) feature a very high F, Rx and L values, and a very low b and red indexes. This is a very good performing formulation.

Obviously the samples containing 16 or 32 g of yellow pigment show a very high yellow index b. The curve at 32 g exhibits additionally a very very low (very close to the center) flow value, what is not well performing.

The curve at 16 g to the contrary exhibits a flow value almost as good as that of the specimen.

It can be seen that the optimum effect of the yellow pigment is at 3.9 % weight/cement (16 kg/m³ cement formulation).

The graphs are actually identical after 15 and 85 days.

Study of the red or black pigment – variation of the dosage in pigment and evaluation of the color vs. time A red or black pigment is used at various dosages as shown in **Table 4 A**.

There is no « restoration carbonate filler ».

- 5 The base filler dosage varies to compensate the addition of pigment, so that the total weight of the « base » cement formulation remains the same.

LG1 tests and Vfunnel tests are as described above.

Table 4B shows the L, a, b, Rx, Ry, Rz after 11 days and 81 days (or 3
10 weeks).

Table 4 C show the results measured at 81 days, see explanations regarding Table 3C.

Figure 4A is a diagram showing again that, with a red pigment, the flow is better at
15 16g than at 32 g.

Table 4 D and **Figure 4 B** show respectively the results at 81 days and the diagram for, this time, the black pigment.

20 Again, the optimal value is 16 g.

Study of the red or yellow or black pigment – variation of the dosage in pigment and evaluation of the color vs. time

- 25 A red or yellow or black pigment is used at various dosages (0% or 3.9% by weight of cement) as shown in **Table 5 A**.

There is no « restoration carbonate filler ».

LG1 tests and Vfunnel tests are as described above.

Vfunnel test is the time for a given slurry to flow out of a funnel.

Table 5B shows the L, a, b, Rx, Ry, Rz at fabrication date, then at + 17 days, then + 39 days, then 80 days, 88 days.

5

Figures 5A, 5B, 5C and 5D respectively show the luminance (or « brightness ») L factor, a factor, b factor and Rx variations as a factor of the specimen base composition (samples P10=P20 no pigment) and of the base composition plus 16 kg (3.9%) of either yellow or red or black pigment as shown in Table 5 A.

10

This shows the negative to very negative impact of the introduction of a pigment in a « base » cement formulation.

15

Study of pigments at 3.9 % or 16 kg / m3 in the base cement composition but with the addition of a fine flowability restoration carbonate so as to restore the flowability.

The fine restoration carbonate filler, here the calcium carbonate Betoflow D as described above, is added at various dosages (fine GCC column) and the amount of base filler (here Betocarb HP as described above) (column « filler ») is adjusted as a consequence.

20

The pigment is dosed at 3.9% of the cement.

Yellow , red or black pigments are used as shown.

25

In this Table, and in all Tables, CHE 100 is a superplastifier **of the polycarboxylate type** as described in the above EPAs. A preferred plastifier can be the Premium 196 CHRYSO additive.

Table 6A shows that the flowability at a distance of 360 mm is reached at 15 g of restoration carbonate filler for the yellow pigment, at only 10 g for the black pigment and that, with the red pigment, the flowability of the « specimen » (0 g pigment) is already at a high value of 370 mm (360 was established as a standard for a « high quality » sufficiently fluid and not too viscous cement composition in the above EPA's) and that 5 or 10 g of restoration filler manage to further improve the flowability to a distance diameter of 380 mm, while it was still further increased at 390 mm at a flowability restoration carbonate filler of 15 g.

Table 6 B shows the L, a, b, Rx, Ry, Rz values at 3 days, 60-63 days and 80-85 days.

Table 6 C shows the measurement at 30 days.

The **Figure 6** is a diagram showing the influence of the fine GCC restoration filler, here in combination with the FIL 099 which is a fine GCC high quality as defined above by its features.

It can be seen that the red pigment does not requires any use of Bw (restoration filler BetoFlow D OG) as to the flowability but that the L value is near zero as well as the Rx value.

To the contrary, when the restoration fine GCC filler is used, with the yellow and black pigment, it can be seen that the flowability is equal to or even slightly above the specimen curve, and that the L and Rx values are not much degraded as compared to the specimen, for the yellow pigment. They are degraded for the black pigment.

That set of diagrams show that it is possible to represent, then to foresee, the impact of a given pigment on the properties of a pigment-containing cement formulation and to select the right pigments as well as the right dosage in pigment and restoration filler (fine GCC).

Study of the pigments behavior at 16 kg/m³ with 0 – 45 kg/m³ of fine GCC restoration filler

- 5 The purpose is to define the % of fine GCC which will restore to the best the initial (with no pigment) flowability of the cement formulation.

Table 7 shows the compositions of the cement formulation and the flow results.

- 10 Various pigments (yellow, red, « ocre » (ochre color), black and blue) have been used, each at a dosage of 16 g, the total weight of the cement formulation remaining constant by adjustment of the amount of filler.

The results of flow show that for two pigments the initial flow is restored or quasi restored (red and black), and well improved for the other pigments.

15

Evidently, for the poorest performing pigments, which are « hard to be flowability-corrected », here namely ochre pigment, the % of fine restoration filler has to be adjusted to improve the flow result up to the initial value.

- 20 This can be done by a few routine flow tests.

Table 8 show the L, a, b, Rx, Ry, Rz at 15 days and 60-63 days, and finally at 80-85 days.

- 25 It is self-explaining. A diagram as above can be drawn from those data.

It confirms that the color stabilizes actually after a period of time of about 85 days.

This is a surprising result, which, as can be seen, is independent on the pigment.

Study of the pigment 1300 X-OM – evaluation of the color with time.

This is represented in **Table 9**.

The formulation contains NO pigment.

- 5 To the right, is mentioned the aspect and workability of the slurry :

In that order :

LP 05 fluid, flexible

- 10 LP 07 fluid, flexible ; slightly compact

LP 09 fluid, slow, compact

LP 10 homogeneous, very compact

Table 10 shows the L, a, b, Rx, Ry, Rz values after 4 days, 60 – 63 days, 80-85 days.

- 15 **Table 11** shows the same base cement formulation where however a part of the base filler is replaced by various amounts of PIG107 (the type and color of the pigment can be determined from the a, b, indexes in Table 11) and various amounts of fine GCC BetoFlow D as restoration filler.

- 20 The results are comparable to those of Table 9.

LP11 (specimen) is fluid, flexible, with a slight degassing

LP13 is fluid and flexible

LP15 is fluid and flexible

LP16 is fluid and compact.

One can see that usable pigment-restoration filler premixes can be at a ratio by weight of: pigment 3 / rest. filler 1.

A premix base filler – rest. filler can be seen at from 256 / 1 by weight to 228 / 8.

- 5 **Table 12** shows the L, a, b, Rx, Ry, Rz values after 4 days, 60 – 63 days, 80-85 days.

Table 13: Study of the lemon pigment . Evaluation of the color vs time

- 10 Table 13A shows the use of various proportions of a yellow pigment in a cement composition not containing a restoration fine GCC, as can be seen the flowability is degraded from 350mm (LP01) to 300 (LP03 and LP 04) what is an example in which the degradation is more than 10% of the flowability.

It is also to be noted that at 1.9% pigment flowability increases to 375 mm

- 15 Table 13B shows L, a, b, Rx, Ry, Rz values for the same samples. It can be see that L luminance index becomes stable at about 44 days, what justifies the need in such a testing, to wait for between and 80 and 90 days before performing the evaluation of L, a reasonable value being 85 days.

EXAMPLE 2

20

This example aims at providing the skilled man with a practical guideline as to how to increase the amount of color pigment to be incorporated into the cement formulation, as above described, in order to reach a better color tone without encountering the negative impact of the color pigment on flowability.

25

The ingredients are as above defined:

- cement CEM 113
- sand SAN 099

- base filler FIL 099 Betocarb HP
- when present, restoration calcium carbonate Betoflow D (FIL 684).

Test and results are presented in the self-explanatory Tables PTR A (evaluation of
5 cement – Admixture compatibility) , PTR B (impact of the pigment addition at 25 or 41
kg/m³), PTR C (impact of Betoflow D and GCC content), PTR D (impact of the
proportion of the blend “pigment + betoflow D”), and corresponding Figures PTR A1,
PTR A2, PTR B1, PTR B2, PTR B3, PTR B4, PTR C1, PTR C2, PTR C3, PTR C4.

10 The above mentioned “practical guideline” is exemplified hereafter in the section “List
of steps”.

In the list of steps and in the tables “Admixture” is defined in the Table in connection
with the footnote below each Table, “Admixture” being the additive (AD1 or AD2).

In the tables, “Target” is a color code.

The code is presented as a color:

- 15 - “R” means Red
- “Y” means Yellow
 - “G” means Green

As an example, in Table PTR A, test A4 leads to a fluid, soft composition
corresponding to a color code Green. To the contrary, test A13 also leads to a fluid,
20 soft composition but with a cone test at only 280 and is attributed a color code Red.
Tests A1, A2, A10, A11 have a paste like consistency and are attributed a color code
Red. Test A3 is flowable as a flowtest at 340mm, and a FVfunnel test at 24 sec. so that
it is attributed a color code Yellow to be compares to the color code Green of test A4.

As an other example, Table PTR B, the fluid soft and high flow test (405 mm) are
25 attributed a color code Green.

This example shows that a very limited number of steps and tests allow the skilled
man to design the cement composition he specifically targets, this composition having
possibly a high color pigment concentration while maintaining a good flowability.

Step 6 is informative in that the flowabilty can be restored with additional water.

Step 7 is also informative in that the flowability can be restored with an additional amount of additive (AD1 or AD2).

ANNEX - TABLES

N°	Sand	Cement	Filler	Fine GCC		Pigment		Water		Additive	LG1		LG1		LG1		Vfunnel
				g	g	%	g	g	g		mm	Test 1	mm	Test 2	mm	Test 3	s
5	P27	SAN099	1430 CEM113	415	FIL099	180	0,0	0,0	230	CHE100	2	360	x	x	x	x	4,9
	P26	SAN099	1390 CEM113	415	FIL099	220	0,0	0,0	230	CHE100	2	355	x	x	x	x	5,0
	P25	SAN099	1350 CEM113	415	FIL099	260	0,0	0,0	230	CHE100	2	390	x	x	x	x	5,1
	P28	SAN099	1310 CEM113	415	FIL099	300	0,0	0,0	230	CHE100	2	330	x	x	x	x	6,7
	P29	SAN099	1270 CEM113	415	FIL099	340	0,0	0,0	230	CHE100	2	250	x	x	x	x	8,3

prepared on 10.11.15

Table 1A

	L	20/11/2014 = 10D						12/12/2014=31D // made 1.05.2015						27/2/2015=97D // made 26.06.2015					
		a	b	Rx	Ry	Rz	L	a	b	Rx	Ry	Rz	L	a	b	Rx	Ry	Rz	
P27	85,1	-0,3	4,2	67,2	66,1	61,5	87,9	-0,3	3,2	72,6	71,9	68,1	87,9	-0,4	2,8	72,5	71,9	68,6	
P26	87,8	-0,3	3,9	72,6	71,6	67,1	89,5	-0,4	3,3	76,0	75,2	71,1	89,5	-0,4	3,3	76,0	75,2	71,2	
P25	87,5	-0,3	3,9	71,9	70,9	66,5	89,3	-0,3	3,3	75,6	74,8	70,8	89,3	-0,4	3,3	75,5	74,7	70,8	
P28	88,3	-0,3	4,1	73,7	72,7	67,9	90,1	-0,3	3,6	77,5	76,6	72,2	90,1	-0,3	3,6	77,5	76,6	72,2	
P29	87,5	-0,3	4,9	72,2	70,9	65,3	90,1	-0,4	3,9	77,5	76,5	71,8	90,0	-0,4	4,0	77,4	76,4	71,5	

D = Days

Table 1B

N°	Sand	Cement	Filler	Fine GCC	Pigment	Water	Additive	LG1
	g	g	g	g	%	g	g	mm
Part 3								
P22	SAN099 1430 CEM113	415 FIL099	180	3,9	yellow	16,0	CHE100	300
P21	SAN099 1390 CEM113	415 FIL099	220	3,9	yellow	16,0	CHE100	340
P20	SAN099 1350 CEM113	415 FIL099	260	3,9	yellow	16,0	CHE100	305
P23	SAN099 1310 CEM113	415 FIL099	300	3,9	yellow	16,0	CHE100	300
P24	SAN099 1270 CEM113	415 FIL099	340	3,9	yellow	16,0	CHE100	230

Part 3

P22	SAN099 1430 CEM113	415 FIL099	180	3,9	yellow	16,0	CHE100	2	300
P21	SAN099 1390 CEM113	415 FIL099	220	3,9	yellow	16,0	CHE100	2	340
P20	SAN099 1350 CEM113	415 FIL099	260	3,9	yellow	16,0	CHE100	2	305
P23	SAN099 1310 CEM113	415 FIL099	300	3,9	yellow	16,0	CHE100	2	300
P24	SAN099 1270 CEM113	415 FIL099	340	3,9	yellow	16,0	CHE100	2	230

prepared on 10.11.2014

Table 2A

L	a	b	Rx	Ry	Rz	L	a	b	Rx	Ry	Rz	L	a	b	Rx	Ry	Rz	
20/11/2014 = 10D																		
P22	72,8	6,6	47,5	55,3	44,6	14,9	74,3	6,2	46,9	57,7	46,8	16,2	P22	74,7	6,1	46,8	58,4	47,5
P21	70,1	7,8	50,9	51,5	40,6	11,7	71,4	7,4	50,4	53,5	42,5	12,7	P21	75,5	6,2	47,1	60,1	48,8
P20	87,6	-0,3	3,7	72,1	71,2	66,9	88,5	-0,3	3,5	73,9	73,1	68,9	P20	88,7	-0,3	3,4	74,3	73,4
P23	73,3	6,4	47,9	56,1	45,3	15,0	74,8	6,1	47,5	58,6	47,6	16,3	P23	76,2	5,7	46,8	61,1	49,9
P24	75,4	5,6	47,0	59,5	48,6	17,0	76,5	5,4	46,6	61,4	50,3	18,1	P24	77,4	5,3	46,4	63,1	51,9
L	a	b	Rx	Ry	Rz	L	a	b	Rx	Ry	Rz	L	a	b	Rx	Ry	Rz	
107D = 27/02/15// effective 01.05																		
XXXD = 26.06.2015 effective																		
P22	74,6	6,1	47,0	58,4	47,4	16,4	74,7	6,07	46,84	58,5	47,56	16,57	x	x	x	x	x	
P21	75,4	6,2	47,2	59,8	48,6	16,9	73,6	6,81	48,91	57	45,77	14,82	x	x	x	x	x	
P20	89,0	-0,3	3,4	74,9	74,1	70,0	88,7	-0,3	3,43	74,4	73,5	69,45	x	x	x	x	x	
P23	76,1	5,7	46,9	60,9	49,7	17,6	75,7	5,88	47,17	60,2	49,04	17,16	x	x	x	x	x	
P24	77,3	5,3	46,5	62,9	51,7	18,8	77,1	5,32	46,46	62,5	51,32	18,64	x	x	x	x	x	

D = Days

Table 2B

Delta base

	L	a	b	Rx	Ry	Rz	L	a	b	Rx
--	---	---	---	----	----	----	---	---	---	----

20/11/2015

Test 10 days

P22	73,5	6,4	47,2	56,5	45,7	15,5	0,0	0,0	0,0	0,0
-----	------	-----	------	------	------	------	-----	-----	-----	-----

P21	70,8	7,6	50,6	52,5	41,5	12,2				
-----	------	-----	------	------	------	------	--	--	--	--

p11	74,1	6,4	48,2	57,5	46,5	15,5				
-----	------	-----	------	------	------	------	--	--	--	--

P23	74,0	6,3	47,7	57,4	46,4	15,6				
-----	------	-----	------	------	------	------	--	--	--	--

P24	75,9	5,5	46,8	60,5	49,5	17,5				
-----	------	-----	------	------	------	------	--	--	--	--

12/12/2015

Test 30 days

P22	74,7	6,1	46,9	58,4	47,5	16,5	1,2	-0,3	-0,2	2,0
-----	------	-----	------	------	------	------	-----	------	------	-----

P21	74,5	6,5	48,0	58,4	47,2	15,9	0,0			
-----	------	-----	------	------	------	------	-----	--	--	--

p11	76,0	5,9	47,2	60,9	49,6	17,4	0,0			
-----	------	-----	------	------	------	------	-----	--	--	--

P23	75,9	5,8	47,0	60,5	49,4	17,4	0,0			
-----	------	-----	------	------	------	------	-----	--	--	--

P24	77,2	5,3	46,5	62,7	51,5	18,7	0,0			
-----	------	-----	------	------	------	------	-----	--	--	--

27/02/2015

Test 107 days

P22

P21

p11

P23

P24

time	17	39	81	88
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Table 2C

N°	Sand	Cement	Filler	Fine GCC	Pigment	Water	Additive	LG1	LG1	LG1	Vfunnel
	g	g	g	g	%	g	g	mm	mm	mm	s
								Test 1	Test 2	Test 3	Test 4
Part 1 - prep 30/10/14											
Base	SAN099	1350 CEM113	415 FIL099	260	0	0,0	230 CHE100	2	380	400	370,0 6,8
P1	SAN099	1350 CEM113	415 FIL099	256	1,0 yellow	4,0	230 CHE100	2	410		x
P2	SAN099	1350 CEM113	415 FIL099	252	1,9 yellow	8,0	230 CHE100	2	345		x
P3	SAN099	1350 CEM113	415 FIL099	248	2,9 yellow	12,0	230 CHE100	2	340		x
P4	SAN099	1350 CEM113	415 FIL099	244	3,9 yellow	16,0	230 CHE100	2	350	285	320,0 x
P5	SAN099	1350 CEM113	415 FIL099	228	7,7 yellow	32,0	230 CHE100	2	225	205	225,0 x

	after 15D										after 85D														
	14/11/2014										23/01/2015														
	L	a	b	Rx	Ry	Rz	L	a	b	Rx	Ry	Rz	L	a	b	Rx	Ry	Rz	L	a	b	Rx	Ry	Rz	
Base	0.0	83.5	-0.2	4.5	64.2	63.1	58.3	86.1	-0.2	3.7	69.1	68.1	63.9	86.5	-0.3	3.8	69.9	68.9	64.7	86.4	-0.3	3.8	69.7	68.8	64.5
P1	4.0	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	
P2	8.0	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	
P3	12.0	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	
P4	16.0	70.4	7.4	50.8	51.7	41.0	11.9	73.0	6.8	51.2	56.1	44.9	13.9	73.8	6.4	49.0	57.1	46.0	14.9	73.7	6.5	49.0	57.1	46.0	14.9
P5	32.0	70.0	8.4	53.3	51.7	40.4	10.8	72.4	7.9	53.3	55.7	43.9	12.3	71.6	8.2	54.4	42.7	11.8	11.8	72.7	7.9	53.2	56.2	44.4	12.5

D = Days

5

10

Evaluation : xx days

Base	L	a	b	Rx	Flow
mini	40	-0,6	-3	10	200
maxi	98	30	55	75	400
delta	58	30,6	58	65	200
0.0 Specimen	86,4	-0,3	3,8	69,7	380
16kg yellow	73,7	6,5	49,0	57,1	350
32kg yellow	72,7	7,9	53,2	56,2	225
Specimen	400	6	58	459	450
16kg yellow	291	116	448	362	375
32kg yellow	282	138	484	356	63

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Table 3C

20

N°	Sand		Cement		Filler		Fine GCC		Pigment			Water	Additive	LG1	LG1	Vfunnel			
		g		g		g		g		%	g						g	mm	mm
														Test 1	Test 2	Test 3	Test 4		
	Part 1 - prep. 30/10/14 + 3/11/2014																		
P6	SAN099	1350	CEM113	415	FIL099	244				3,9	red	16,0	230	CHE100	2	390	350	340	x
P7	SAN099	1350	CEM113	415	FIL099	228				7,7	red	32,0	230	CHE100	2	400	290	270	x
P8	SAN099	1350	CEM113	415	FIL099	244				3,9	black	16,0	230	CHE100	2	320	330	350	x
P9	SAN099	1350	CEM113	415	FIL099	228				7,7	black	32,0	230	CHE100	2	305	255	260	x
Base	SAN099	1350	CEM113	415	FIL099	260				0		0,0	230	CHE100	2	380	400	370,0	6,8

Table 4A

g/l	after 11D										after 81D - 3 samples														
	L	a	b	Rx	Ry	Rz	L	a	b	Rx	Ry	Rz	L	a	b	Rx	Ry	Rz	L	a	b	Rx	Ry	Rz	
14/11/2014																									
P6	49,3	28,0	15,2	26,7	17,7	11,5	48,1	28,5	15,9	25,6	16,7	10,6	48,2	28,8	16,2	25,8	16,8	10,5							
P7	42,9	32,0	20,8	21,7	13,0	6,6	44,2	31,8	19,6	22,8	13,9	7,5	44,6	32,1	19,9	23,3	14,1	7,5							
P8	47,6	1,1	-1,6	16,5	16,5	17,2	51,9	1,0	-1,8	20,1	20,1	21,0	52,7	0,9	-2,3	20,7	20,8	22,0							
P9	41,1	1,3	-0,6	12,1	11,9	12,2	39,3	1,7	-0,8	11,1	10,8	11,1	42,5	1,4	-1,2	12,9	12,8	13,3							
Base													86,4	-0,3					86,4	-0,3		3,8	69,7	68,8	64,5

Table 4B

Evaluation : 81 days

Base	L	a	b	Rx	Flow
mini	40	-0,6	-3	10	200
maxi	98	30	55	75	400
delta	58	30,6	58	65	200
0.0 Specimen	86,4	-0,3	3,8	69,7	370
16kg red	48,2	28,8	16,2	25,8	340
32kg red	44,6	32,1	19,9	23,3	270
Specimen	400	6	58	459	425
16kg red	71	481	166	122	350
32kg red	39	534	197	102	175

Table 4C

5	N°	Sand	g	Cement	g	Filler	Fine GCC		Pigment	Water Additive		LG1		
							g	%		g	g			
Part 1														
	P10=P20	SAN099	1350	CEM113	415	FIL099	260		0		230	CHE100	2	400
	P11	SAN099	1350	CEM113	415	FIL099	244		3,9	yellow	16,0	CHE100	2	290
	P12	SAN099	1350	CEM113	415	FIL099	244		3,9	black	16,0	CHE100	2	370
	P13	SAN099	1350	CEM113	415	FIL099	244		3,9	red	16,0	CHE100	2	300

Table 5A

		"Disque"						Delta base				
		g/l	L	a	b	Rx	Ry	Rz	L	a	b	Rx
5												
	P10=P20	o	85,4	-0,2	4,4	68,0	66,9	62,0		0,0	0,0	0,0
	P11	o	74,4	6,2	48,0	58,0	47,0	15,8		0,0	0,0	0,0
	P12	o	48,0	29,0	16,4	25,7	16,6	10,3		0,0	0,0	0,0
	P13	o	49,8	0,8	-1,6	18,2	18,2	19,0		0,0	0,0	0,0
			03/11/2014									
			20/11/2014									
						V						
	P10	o	86,0	-0,2	4,1	69,1	68,1	63,4		0,6	0,0	-0,3
10	P11	o	74,1	6,4	48,2	57,5	46,5	15,5		-0,3	0,1	0,2
	P12	o	48,8	28,8	16,1	26,4	17,3	10,9		0,8	-0,2	-0,4
	P13	o	51,8	0,8	-1,8	20,0	20,0	20,9		2,1	0,0	-0,2
			12/12/2014									
						V						
	P10		87,4	-0,2	3,7	71,9	70,9	66,6		2,0	0,0	-0,7
	P11		76,0	5,9	47,2	60,9	49,6	17,4		1,7	-0,4	-0,9
	P12		50,5	28,3	15,4	28,1	18,7	12,2		2,5	-0,7	-1,0
	P13		53,1	0,8	-2,0	21,1	21,2	22,2		3,4	0,0	-0,4
			23/01/2015									
						V						
	P10		88,4	-0,3	3,4	73,7	72,8	68,8		2,9	0,0	-1,0
	P11		76,4	5,8	47,2	61,5	50,3	17,8		2,1	-0,5	-0,9
	P12		51,2	28,2	15,1	28,8	19,3	12,8		3,2	-0,8	-1,4
	P13		54,7	0,8	-2,2	22,5	22,6	23,8		4,9	0,0	-0,6
			30/01/2015									
						V						
	P10		88,3	-0,2	3,4	73,4	72,5	68,6		2,8	0,0	-1,0
	P11		76,3	5,8	47,1	61,4	50,1	17,7		2,0	-0,4	-0,9
	P12		51,3	28,1	14,9	28,9	19,4	12,9		3,3	-0,9	-1,5
	P13		54,7	0,8	-2,2	22,5	22,6	23,9		4,9	0,0	-0,6
	time		17	39	81	88						

Table 5B

N°	Sand	Cement	Filler	Fine GCC	Pigment	Water	Additive	Flow
	g	g	g	g	%	g	g	mm
								Test 1
	Part 1							
P11	SAN099	1350 CEM113	415 FIL099	260	0	3,9 yellow	CHE100	2 305
P14	SAN099	1350 CEM113	415 FIL099	239 FIL669	5	3,9 yellow	CHE100	2 345
P15	SAN099	1350 CEM113	415 FIL099	234 FIL669	10	3,9 yellow	CHE100	2 340
P16	SAN099	1350 CEM113	415 FIL099	229 FIL669	15	3,9 yellow	CHE100	2 360
P13	SAN099	1350 CEM113	415 FIL099	260		3,9 black	CHE100	2 300
P17	SAN099	1350 CEM113	415 FIL099	239 FIL669	5	3,9 black	CHE100	2 360
P18	SAN099	1350 CEM113	415 FIL099	234 FIL669	10	3,9 black	CHE100	2 360
P19	SAN099	1350 CEM113	415 FIL099	229 FIL669	15	3,9 black	CHE100	2 360
P12	SAN099	1350 CEM113	415 FIL099	260	0	3,9 red	CHE100	2 370
P35	SAN099	1350 CEM113	415 FIL099	239 FIL669	5	3,9 red	CHE100	2 380
P36	SAN099	1350 CEM113	415 FIL099	234 FIL669	10	3,9 red	CHE100	2 380
P37	SAN099	1350 CEM113	415 FIL099	229 FIL669	15	3,9 red	CHE100	2 390

Prepared on 27.01.2015

Evaluation : 03 days

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Base	L	a	b	Rx	Flow
mini	40	-0,6	-3	10	200
maxi	98	30	55	75	400
delta	58	30,6	58	65	200

Specimen	86,4	-0,3	3,8	69,7	370
16kg yellow+Bw	71,3	6,8	50,0	53,0	360
16kg red	48,0	29,0	16,4	25,7	370
16kg black+Bw	54,6	0,5	-1,4	22,5	380

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Specimen	400	5	59	459	425
16kg yellow+Bw	270	122	457	331	400
16kg red	69	484	168	121	425
16kg black+Bw	126	18	14	96	450

Bw = fine GCC (Betoflow)

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Table 6C

20

N°	Sand	Cement	Filler	Fine GCC		Pigment	Bw/Bw+Pi	Water	Additive	Flow
	g	g	g	g	%	g	g	g	g	mm
										Test 1
Partie 1										
DF0	SAN099 1350	CEM113 415	FIL099 260	FIL669 0	base	0,0		230	CHE100 2	370
DF5	SAN099 1350	CEM113 415	FIL099 235	FIL669 25	3,9 PIG110 yellow	16,0	61,0	230	CHE100 2	355
DF15	SAN099 1350	CEM113 415	FIL099 235	FIL669 25	3,9 PIG112 red	16,0	61,0	230	CHE100 2	370
DF21	SAN099 1350	CEM113 415	FIL099 235	FIL669 25	3,9 PIG113 ochre	16,0	61,0	230	CHE100 2	345
DF10	SAN099 1350	CEM113 415	FIL099 225	FIL669 35	3,9 PIG111 black	16,0	68,6	230	CHE100 2	365
DF29	SAN099 1350	CEM113 415	FIL099 215	FIL669 45	3,9 PIG114 blue	16,0	73,8	230	CHE100 2	350

	15D						60-63 days						80-85days					
	27/03/2015			19/06/2015			17/07/2015											
	L	a	b	Rx	Ry	Rz	L	a	b	Rx	Ry	Rz	L	a	b	Rx	Ry	Rz
DF0	86,9	-0,4	3,9	70,7	69,8	65,4 DF000	88,6	-0,4	3,22	74,1	73,4	69,6	88,9	-0,42	3,19	74,7	73,9	70,2
DF5	75,5	5,9	48,4	60,0	48,8	16,5 DF5	77,1	5,5	47,4	62,7	51,3	18,2	77,1	5,42	46,8	62,7	51,4	18,5
DF15	49,4	31,0	22,1	28,3	17,8	9,3 DF15	50,5	30,7	21,4	29,3	18,6	10,1	50,6	30,5	21,2	29,4	18,8	10,3
DF21	63,4	21,4	39,4	45,1	31,8	11,6 DF21	64,1	21	38,6	46	32,7	12,4	64,3	20,9	38,3	46,2	32,9	12,6
DF10	57,8	0,0	0,4	25,8	25,8	25,6 DF100	61,6	-0,02	0,21	29,9	29,9	29,8	61,7	-0,04	0,23	30,1	30,1	29,9
DF29	65,8	-10,7	-25,5	25,6	35,3	57,8 DF29	69,2	-11	-24	29,7	39,9	62,3	69,5	-11	-24	30,1	40,2	62,6

Table 8

N°	Sand	Cement	Filler	Fine GCC	Pigment	Water	Additive	LG1	remarques
4/12/14	g	g	g	g	%	g	g	mm	
Part 1									
LP05	SAN099	1350 CEM113 415 FIL099	260 FIL684			230	CHE100 2	385	fluide, souple
LP07	SAN099	1350 CEM113 415 FIL099	252 FIL684	8		230	CHE100 2	310	fluide, souple; léger compact
LP09	SAN099	1350 CEM113 415 FIL099	244 FIL684	16		230	CHE100 2	180	fluide, lent, compact
LP10	SAN099	1350 CEM113 415 FIL099	228 FIL684	32		230	CHE100 2	160	homogène très compact

5		L	a	b	Rx	Ry	Rz	G
	06/2/15 = 4D							
	LP05	87,4	-0,4	4,1	71,8	70,9	66,1	
	LP07	88,3	-0,4	4,3	73,7	72,7	67,6	
	LP09	88,0	-0,5	4,8	73,3	72,1	66,6	
10	LP10	88,4	-0,5	4,7	73,9	72,8	67,4	
		L	a	b	Rx	Ry	Rz	G
	60-63D = 03/4/15							
	LP05	88,2	-0,4	3,7	73,4	72,5	68,3	
	LP07	89,9	-0,4	3,7	76,9	76,0	71,6	
15	LP09	89,5	-0,5	4,1	76,2	75,3	70,3	
	LP10	89,8	-0,5	4,0	76,7	75,8	70,9	
		L	a	b	Rx	Ry	Rz	G
	80-85D = 30/4/15							
	LP05	88,4	-0,4	3,7	73,7	72,8	68,4	
	LP07	89,9	-0,4	3,7	76,9	76,1	71,6	
	LP09	89,6	-0,5	4,1	76,3	75,4	70,4	
	LP10	89,9	0,5	4,0	77,0	76,1	71,2	

Table 10

N°	Sand	Cement	Filler	Fine GCC	Pigment	Water	Additive	LG1	remarques
4/12/14	g	g	g	g	%	g	g	mm	
Part 1									
LP11	SAN099	1350 CEM113	415 FIL099	260 FIL684	0	0,0	CHE100	2	395 fluide, souple, léger dégazage
LP12	SAN099	1350 CEM113	415 FIL099	256 FIL684	1,0	3,0	CHE100	2	
LP13	SAN099	1350 CEM113	415 FIL099	252 FIL684	2,0	6,0	CHE100	2	370 fluide, souple
LP14	SAN099	1350 CEM113	415 FIL099	248 FIL684	3,0	9,0	CHE100	2	
LP15	SAN099	1350 CEM113	415 FIL099	244 FIL684	4,0	12,0	CHE100	2	350 fluide, souple
LP16	SAN099	1350 CEM113	415 FIL099	228 FIL684	8,0	24,0	CHE100	2	290 fluide, compact

Table 11

		L	a	b	Rx	Ry	Rz		L	a	b	Rx	Ry	Rz
		06/2/15 = 4D												
5	LP11	87,1	-0,4	4,3	71,1	70,1	65,2		87,0	-0,4	4,3	71,0	70,0	65,1
	LP13	89,0	-0,5	4,1	75,2	74,2	69,4		89,2	-0,5	4,1	75,5	74,6	69,7
	LP15	90,0	-0,5	3,8	77,1	76,2	71,5		90,2	-0,5	3,8	77,6	76,7	72,0
	LP16	91,2	-0,6	3,8	79,8	78,9	74,2		90,9	-0,6	3,9	79,0	78,2	73,3
		60-63D = 03/4/15												
	LP11													
	LP13													
	LP15													
	LP16													
		80-85D = 30/04/15												
10	LP11								88,5	-0,4	3,7	73,9	73,0	68,6
	LP13								90,3	-0,5	3,6	77,8	77,0	72,6
	LP15								91,1	-0,5	3,4	79,5	78,8	74,5
	LP16								91,7	-0,6	3,6	80,8	80,0	75,4
15	LP11	88,5	-0,4	3,7	74,0	73,1	68,7							
	LP13	90,4	-0,5	3,6	78,0	77,2	72,8							
	LP15	91,1	-0,5	3,5	79,6	78,8	74,4							
	LP16	91,9	-0,6	3,5	81,3	80,6	76,1							

Table 12

N°	Sand	Cement	Filler	Fine GCC	Pigment	Water	Additive	LG1
	g	g	g	g	%	g	g	mm
Partie 1								
LP01	SAN099	1350 CEM113	415 FIL099	260	0	0,0	CHE100	2 350
LP02	SAN099	1350 CEM113	415 FIL099	252	1,9 PIG107	8,0	CHE100	2 375
LP03	SAN099	1350 CEM113	415 FIL099	244	3,9 PIG107	16,0	CHE100	2 300
LP04	SAN099	1350 CEM113	415 FIL099	228	7,7 PIG107	32,0	CHE100	2 300

Table 13A

L				L				L				L						
a				a				a				a						
b				b				b				b						
Rx				Rx				Rx				Rx						
Ry				Ry				Ry				Ry						
Rz				Rz				Rz				Rz						
19/12/2014 = 15D																		
LP01	86,6	-0,3	4,7	70,3	69,2	63,9	85,3	-0,3	5,3	67,9	66,6	60,8	85,7	-0,3	5,2	68,6	67,3	61,6
LP02	89,5	-0,5	3,9	76,2	75,3	70,5	88,8	-0,4	4,1	74,7	73,8	68,9	88,8	-0,5	4,1	74,8	73,8	68,9
LP03	90,7	-0,5	3,7	78,7	77,8	73,3	90,3	-0,5	3,8	77,8	77,0	72,3	90,5	-0,5	3,7	78,2	77,4	72,7
LP04	91,2	-0,6	3,6	79,7	79,0	74,4	91,8	-0,5	3,3	81,0	80,2	76,0	91,9	-0,5	3,4	81,1	80,4	76,0
23/01/2015 = 50D																		
LP01	87,9	-0,3	4,1	73,0	71,9	67,2	87,8	-0,3	4,1	72,7	71,6	66,9	88,3	-0,3	3,9	73,7	72,8	68,2
LP02	89,9	-0,4	3,7	77,0	76,1	71,6	89,9	-0,4	3,7	76,9	76,0	71,5	90,2	-0,5	3,7	77,5	76,6	72,1
LP03	91,2	-0,5	3,4	79,8	79,0	74,7	91,1	-0,5	3,5	79,5	78,7	74,4	91,3	-0,5	3,5	79,9	79,1	74,8
LP04	92,3	-0,5	3,3	82,0	81,3	77,1	92,2	-0,5	3,2	81,9	81,2	77,2	91,5	-0,6	3,6	80,3	79,6	75,0
30/1/2015 = 57D																		
LP01	88,5	-0,3	3,9	74,1	73,1	68,6	88,0	-0,3	4,0	73,1	72,0	67,4	88,0	-0,3	4,0	73,0	72,0	67,3
LP02	90,2	-0,5	3,7	77,5	76,6	72,1	89,8	-0,4	3,7	76,8	75,9	71,5	89,9	-0,4	3,7	77,0	76,1	71,7
LP03	91,4	-0,5	3,4	80,1	79,3	75,0	91,1	-0,5	3,5	79,5	78,7	74,4	91,3	-0,5	3,4	79,9	79,1	74,8
LP04	91,4	-0,6	3,6	80,1	79,3	74,8	92,4	-0,5	3,2	82,3	81,6	77,5	92,3	-0,5	3,3	82,1	81,4	77,2
27/2/15 = 84D																		
###																		
LP01	88,5	-0,3	3,9	74,0	73,0	69,6												
LP02	89,9	-0,4	3,6	77,0	76,1	71,7												
LP03	91,4	-0,5	3,4	80,2	79,4	75,1												
LP04	92,2	-0,5	3,3	81,9	81,1	76,9												
###																		
LP01	88,6	-0,4	3,8	74,2	73,2	68,7												
LP02	89,9	-0,4	3,6	76,9	76,1	71,7												
LP03	91,5	-0,5	3,4	80,3	79,5	75,2												
LP04	92,3	-0,5	3,2	82,0	81,3	77,2												

D = Days

1	Make the choice of the local white cement (EN 197-1) to complete : CEN sand (EN 196-1), GCC (NF P 18-508), Water	CEM II/A-LL 42.5 from XX		
2	Make the choice of the admixture (EN 934-2)	Here is the requested evaluation of Cement-Admixture compatibility	A	Flow test, viscosity, color 28D
3	Introduce the pigment in substitution of the "GCC" part	Pigment is incorporated at 25 & 41 kg/m ³ .	B	Flow test, viscosity, color 28D
4	At 25 & 41kg/m ³ of pigment, adjust the flowability with an additional weight of Betoflow D. Betoflow D is incorporated in substitution of "GCC" part	Pigment is fixed at 25 & 41kg/m ³ . Only move Betoflow D and GCC content.	C	Flow test, viscosity, color 28D
5	Increase the proportion of the innovative blend "pigment+Betoflow D" until 260 kg/m ³	Replace the proportion of GCC	D	Flow test, viscosity, color 28D
6	At 41kg/m ³ of pigment, adjust the flowability with an additional weight of Water.	Pigment is constant at 41kg/m ³ . Only adjust the water part.		Flow test, viscosity, density, strength 1D&28D, color 10D & 85D
7	At 41kg/m ³ of pigment, adjust the flowability with an additional weight of admixture.	Pigment is constant at 41kg/m ³ . Only adjust the admixture part.		Flow test, viscosity, density, strength 1D&28D, color 10D & 85D

List of Steps

N°	Sand	Cement	GCC	Betoflow D	Pigment	Water	Additive	Flow test	Flow test	Visual observation	Target
	g	g	g	%	g name	g	g	mm	sec		
								Mini cone	FVFunnel		
A1	SAN099 1350	CEM113 415	FIL099 260	-	0.0	0.0	AD1 1	200	ND	paste like consistency	R
A2	SAN099 1350	CEM113 415	FIL099 260	-	0.0	0.0	AD1 1.25	240	ND	paste like consistency	R
A3	SAN099 1350	CEM113 415	FIL099 260	-	0.0	0.0	AD1 1.5	340	24	flowable	Y
A4	SAN099 1350	CEM113 415	FIL099 260	-	0.0	0.0	AD1 1.8	405	4.3	Fluid, soft	G
A5	SAN099 1350	CEM113 415	FIL099 260	-	0.0	0.0	AD1 2.1	410	4	bleeding, segregation	Y
A10	SAN099 1350	CEM113 415	FIL099 260	-	0.0	0.0	AD2 1.8	100	ND	paste like consistency	R
A11	SAN099 1350	CEM113 415	FIL099 260	-	0.0	0.0	AD2 2.3	150	ND	paste like consistency	R
A12	SAN099 1350	CEM113 415	FIL099 260	-	0.0	0.0	AD2 2.8	210	ND	flowable	R
A13	SAN099 1350	CEM113 415	FIL099 260	-	0.0	0.0	AD2 3.3	280	ND	Fluid, soft	R
A14	SAN099 1350	CEM113 415	FIL099 260	-	0.0	0.0	AD2 3.8	330	22	bleeding, segregation	Y

Purpose

Admixture content from 1.5 to 2.5 g/l to achieve the flowability target :

- flow test : 370-420 mm

- flow test : <10 sec

TABLE PTR A

N°	Sand	Cement	GCC	Pigment	Water	Additive	Flow test	Flow test	Visual observation	Target	L	a	b	Rx	Ry	Rz						
	g	g	g	name	g	g	mm	sec		28D	28D	28D	28D	28D	28D	28D						
							Mini cone	FVFunnel														
P0	SAN099	1350	CEM113	415	FIL099	260	0.0	0.0	230	AD1	1.8	405	4.3	Fluid, soft	G	86.1	0.4	5.1	69.8	68.5	62.5	260.0
P10	SAN099	1350	CEM113	415	FIL099	235	Red	25.0	230	AD1	1.8	290	ND	flowable	R	47.1	32.6	22.0	27.2	16.8	8.2	260.0
P11	SAN099	1350	CEM113	415	FIL099	219	Red	41.0	230	AD1	1.8	250	ND	low flow	R	43.4	34.0	24.3	23.9	14.1	6.0	260.0
P0	SAN099	1350	CEM113	415	FIL099	260	0.0	0.0	230	AD1	1.8	405	4.3	Fluid, soft	G	86.1	0.4	5.1	69.8	68.5	62.5	260.0
P36	SAN099	1350	CEM113	415	FIL099	235	Yellow	25.0	230	AD1	1.8	207	ND	low flow	R	72.2	13.2	49.7	57.8	46.5	13.8	260.0
P37	SAN099	1350	CEM113	415	FIL099	219	Yellow	41.0	230	AD1	1.8	160	ND	paste like consistency	R	70.7	14.2	50.9	55.7	44.3	12.3	260.0
P0	SAN099	1350	CEM113	415	FIL099	260	0.0	0.0	230	AD1	1.8	405	4.3	Fluid, soft	G	86.1	0.4	5.1	69.8	68.5	62.5	260.0
P29	SAN099	1350	CEM113	415	FIL099	235	Blue	25.0	230	AD2	2.3	237	ND	low flow	R	63.8	-18.0	-29.5	19.8	30.4	58.5	260.0
P30	SAN099	1350	CEM113	415	FIL099	219	Blue	41.0	230	AD2	2.8	170	ND	paste like consistency	R	59.9	-17.1	-33.3	15.8	25.8	55.5	260.0
P0	SAN099	1350	CEM113	415	FIL099	260	0.0	0.0	230	AD1	1.8	405	4.3	Fluid, soft	G	86.1	0.4	5.1	69.8	68.5	62.5	260.0
P2	SAN099	1350	CEM113	415	FIL099	235	Black	25.0	230	AD2	2.3	275	ND	low flow	R	45.5	1.2	-1.1	15.1	14.9	15.4	260.0
P3	SAN099	1350	CEM113	415	FIL099	219	Black	41.0	230	AD2	2.8	220	ND	low flow	R	36.0	1.5	-0.3	9.3	9.0	9.1	260.0

Purpose

Contribution of the pigment on the flowability and color properties of a selected cement formulation (Sand, cement, GCC, additive).

Pigment content at 25 & 41 kg/m³

- flow test : 370-420 mm

- flow test : <10 sec

TABLE PTR B

N°	Sand	Cement	GCC	Betoflow D	Pigment	Water	Additive	Flow test	Flow test	Visual observation	Target	L	a	b	Rx	Ry	Rz
	g	g	g	g	name	g	g	mm	sec		28D	28D	28D	28D	28D	28D	28D
								Mini cone	FVFunnel								
P0	SAN099 1350	CEM113 415	FIL099 260	0	0.0	0.0	230	AD1 1.8	405	4.3	G	86.1	0.4	5.1	69.8	68.5	62.5
																	260.0
P13	SAN099 1350	CEM113 415	FIL099 195	40	Red	25.0	230	AD1 1.8	410	<15	G	44.8	33.7	23.8	25.2	15.1	6.7
																	260.0
P14	SAN099 1350	CEM113 415	FIL099 153	66	Red	41.0	230	AD1 1.8	407	<15	G	40.8	34.5	25.7	21.6	12.4	4.7
																	260.0
P0	SAN099 1350	CEM113 415	FIL099 260	0	0.0	0.0	230	AD1 1.8	405	4.3	G	86.1	0.4	5.1	69.8	68.5	62.5
																	260.0
P48	SAN099 1350	CEM113 415	FIL099 165	70	Yellow	25.0	230	AD1 1.8	408	<15	G	68.2	14.5	51.0	51.4	40.5	10.7
																	260.0
P47	SAN099 1350	CEM113 415	FIL099 102	117	Yellow	41.0	230	AD1 1.8	402	<15	G	66.8	15.7	52.7	49.7	38.7	9.4
																	260.0
P0	SAN099 1350	CEM113 415	FIL099 260	0	0.0	0.0	230	AD1 1.8	405	4.3	G	86.1	0.4	5.1	69.8	68.5	62.5
																	260.0
P50	SAN099 1350	CEM113 415	FIL099 120	115	Blue	25.0	230	AD2 2.3	400	<15	G	60.6	-19.4	-30.0	16.4	26.6	53.3
																	260.0
P51	SAN099 1350	CEM113 415	FIL099 28	191	Blue	41.0	230	AD2 2.8	375	<15	G	58.8	-18.0	-33.2	14.7	24.6	53.4
																	260.0
P0	SAN099 1350	CEM113 415	FIL099 260	0	0.0	0.0	230	AD1 1.8	405	4.3	G	86.1	0.4	5.1	69.8	68.5	62.5
																	260.0
P6	SAN099 1350	CEM113 415	FIL099 180	55	Black	25.0	230	AD2 2.3	405	<15	G	46.9	0.7	-1.7	15.9	15.9	16.7
																	260.0
P7	SAN099 1350	CEM113 415	FIL099 128	91	Black	41.0	230	AD2 2.8	385	<15	G	43.4	0.8	-1.9	13.4	13.4	14.2
																	260.0

Purpose

Contribution of the combination "pigment & Betoflow D" on the flowability and color properties of a selected cement formulation.

TABLE PTR C

Pigment content at 25 & 41 kg/m3. For each dosage the Betoflow D content is adjusted to achieve the flowability target. Betoflow D is added in substitution of the GCC part.

- flow test : 370-420 mm

- flow test : <10 sec

N°	Sand	Cement	GCC	Betoflow D	Pigment	Water	Additive	Flow test	Flow test	Visual observation	Target	L	a	b	Rx	Ry	Rz
	g	g	g	g	name	g	g	mm	sec		28D	28D	28D	28D	28D	28D	28D
P0	SAN099 1350	CEM113 415	FIL099 260	0	0.0	0.0	230	AD1 1.8	405	Fluid, soft	G	86.1	0.4	5.1	69.8	68.5	62.5
P10	SAN099 1350	CEM113 415	FIL099 235	0	Red	25.0	230	AD1 1.8	ND	flowable	R	47.1	32.6	22.0	27.2	16.8	8.2
P13	SAN099 1350	CEM113 415	FIL099 195	40	Red	25.0	230	AD1 1.8	<15	Fluid, soft	G	44.8	33.7	23.8	25.2	15.1	6.7
P14	SAN099 1350	CEM113 415	FIL099 153	66	Red	41.0	230	AD1 1.8	<15	Fluid, soft	G	40.8	34.5	25.7	21.6	12.4	4.7
P27	SAN099 1350	CEM113 415	FIL099 0	160	Red	100	230	AD1 1.8	<15	Fluid, soft	G	36.9	35.2	29.1	18.4	10.1	3.0
P0	SAN099 1350	CEM113 415	FIL099 260	0	0.0	0.0	230	AD1 1.8	4.3	Fluid, soft	G	86.1	0.4	5.1	69.8	68.5	62.5
P36	SAN099 1350	CEM113 415	FIL099 235	0	Yellow	25.0	230	AD1 1.8	ND	low flow	R	72.2	13.2	49.7	57.8	46.5	13.8
P48	SAN099 1350	CEM113 415	FIL099 165	70	Yellow	25.0	230	AD1 1.8	<15	Fluid, soft	G	68.2	14.5	51.0	51.4	40.5	10.7
P47	SAN099 1350	CEM113 415	FIL099 102	117	Yellow	41.0	230	AD1 1.8	<15	Fluid, soft	G	66.8	15.7	52.7	49.7	38.7	9.4
P45	SAN099 1350	CEM113 415	FIL099 0	192	Yellow	68.0	230	AD1 1.8	<15	Fluid, soft	G	65.2	16.3	51.9	47.3	36.5	8.8
P0	SAN099 1350	CEM113 415	FIL099 260	0	0.0	0.0	230	AD1 1.8	4.3	Fluid, soft	G	86.1	0.4	5.1	69.8	68.5	62.5
P29	SAN099 1350	CEM113 415	FIL099 235	0	Blue	25.0	230	AD2 2.3	ND	low flow	R	63.8	-18.0	-29.5	19.8	30.4	58.5
P50	SAN099 1350	CEM113 415	FIL099 120	115	Blue	25.0	230	AD2 2.3	<15	Fluid, soft	G	60.6	-19.4	-30.0	16.4	26.6	53.3
P51	SAN099 1350	CEM113 415	FIL099 28	191	Blue	41.0	230	AD2 2.8	<15	Fluid, soft	G	58.8	-18.0	-33.2	14.7	24.6	53.4
P52	SAN099 1350	CEM113 415	FIL099 0	214	Blue	46.0	230	AD2 2.8	<15	Fluid, soft	G	58.8	-17.9	-33.9	14.5	24.6	54.1
P0	SAN099 1350	CEM113 415	FIL099 260	0	0.0	0.0	230	AD1 1.8	4.3	Fluid, soft	G	86.1	0.4	5.1	69.8	68.5	62.5
P2	SAN099 1350	CEM113 415	FIL099 235	0	Black	25.0	230	AD2 2.3	ND	low flow	R	45.5	1.2	-1.1	15.1	14.9	15.4
P6	SAN099 1350	CEM113 415	FIL099 180	55	Black	25.0	230	AD2 2.3	<15	Fluid, soft	G	46.9	0.7	-1.7	15.9	15.9	16.7
P7	SAN099 1350	CEM113 415	FIL099 128	91	Black	41.0	230	AD2 2.8	<15	Fluid, soft	G	43.4	0.8	-1.9	13.4	13.4	14.2
P24	SAN099 1350	CEM113 415	FIL099 0	177	Black	83.0	230	AD2 2.8	<15	Fluid, soft	G	28.8	1.2	-1.2	5.9	5.8	6.0

Purpose

Contribution of the best combination "Pigment & Betoflow D" on the flowability and color properties of a selected cement formulation. The dosage of this innovative "combination" is pushed until 260 kg/m3 to enhance the color of the final product.

This is demonstrated for all pigments.

TABLE PTR D

CLAIMS

1. **Process for improving the « performance »**, namely the fluidity or consistency
 5 or flowability, of a « base » white-or-grey cement composition comprising white or grey
 cement, optionally but much preferably a base filler, and / or of the sand, and / or of
 any further particulate ingredient, particulate solid ingredient, a pigment, and water, is
characterized in that it comprises replacing a portion of the « base » filler, if any, and/
 10 or of the sand, and / or of any further particulate ingredient, particulate solid ingredient
 with an effective amount of a fine « restoration » calcium carbonate

and in that the said fine restoration calcium carbonate filler pertains to the class of fine
 calcium carbonates characterized by:

0.5 micron < d50 < 5 microns
 15 Preferably 1 micron < d50 < 3 microns
 90 % < CaCO₃ content < 100

and in that the said « restoration » fine calcium carbonate filler is incorporated in a
 proportion of from 0.1 % up to 5 % by the total weight of the whole cement
 20 formulation.

2. Process according to claim 1, characterized in that the said fine calcium
 carbonate filler used as « restoration calcium carbonate filler» is a fine GCC, ground
 calcium carbonate, or « natural », such as a ground marble, chalk, limestone or
 25 dolomie featuring :

d50 3 microns CaCO₃ 98.6 % w 100% passing 63 microns sieve Methylene
 blue test 0.33 g/kg,

or a fine PCC featuring about the same properties or blends thereof.

3. Process according to claim 1, characterized in that the said the fine restoration carbonate fillers are fine GCCs featuring :

90-95-100 % passing 63 microns sieve

d50 < 5 microns

5 CaCO₃ content of at least 85 pref. at least 90 % weight CaCO₃ ,

with representative examples of fine GCCs featuring :

d50 of 2.8 or 4.3 or 4.0 or 4.8 or 2.8 or 3.0 with respective Blaine surface) of (m²/kg) 1018 or 1135 or 942 or 937 or 1022 or 1102, respectively.

10

4. Process according to claims 1 to 3, characterized in that preferably the said « restoration » fine calcium carbonate filler is incorporated in a proportion of from 0.5 % up to 3% by the total weight of the whole cement formulation, preferably the said « restoration » fine calcium carbonate filler is incorporated in a proportion of from 0.5 % up to 2 % by the total weight of the whole cement formulation .

15

5. Process according to claims 1 to 4, characterized in that the base cement formulation contains no base filler.

20 6. Process according to claims 1 to 5, characterized in that the base fillers is selected among carbonates, calcium carbonates, metakaolin, kaolin, dolomie, fly ashes, « laitiers de ciment », organo – and alumino-siliceous fillers, and their blends, and preferably the base filler is a GCC calcium carbonate filler featuring the following properties :

25 d50 5 to 20 microns preferably 1 to 5 microns

Passing 63 microns sieve > 70 %

pref. 100 %

Passing 125 > 85 %
 pref. 100%

5 Passing 2 mm 100 % (both)

Blaine surface > 220 m² / kg
 pref. > 900 m² / kg

10 and / or the base filler is a natural product GCC with a high purity and « cleanliness » with :

CaCO₃ + MgCO₃ > 90 % with CaCO₃ > 65% pref. CaCO₃ > 95 %

15 Methylene blue test < 10 g / kg.

7. Process according to claims 1 to 6, characterized in that the base filler is made of a blend of a base filler with an alumino-siliceous or organo-siliceous filler as defined in claim 6.

20 .

8. Process according to claim 1 to 7 characterized in that the color pigment is added at a dosage of 0 – 40 kg/m³, pref. 1 to 5 to 15 – 35 kg/m³ of the whole cement formulation, and an equivalent amount of a solid material such as cement and/or sand, and/or gravel if a concrete, is removed from the « reference cement formulation », preferably characterized in that the pigment is added are in the range of 10 to 35 kg/m³ , preferably characterized in that the pigment is added in a range of 16 and 32 kg/m³ by weight of the whole cement formulation, preferably characterized in that the

25

pigment is added at a dosage of 16 kg/m³ of cement formulation, or 3.9 % by weight of cement.

9. Process according to claim 1 to 8 characterized in that the proportion of
5 pigments is a weight pigment to cement ratio from 0 to 15 %, in particular 0.1 % or 2, 5 %, namely 1 %.

10. Process according to claim 1 to 9 characterized in that a superplasticizer is used
as « Additive » in a proportion of from 0 to 3 % by weight of cement.

10

11. Process according to claim 10 characterized in that the superplasticiser is
chosen in the following families :

- polycarbonates
- polycarboxylates
- 15 - polycarboxylate-ethers
- iminosulfonates,

preferably the superplasticizer is a polycarboxylate.

20 12. **Cement formulations** comprising a white or grey cement, water, sand, a base
filler, a pigment and a restoration carbonate filler and characterized in that it is
prepared by the process according to the above claims 1 to 11.

25 13. Cement formulations according to claim 12 characterized in that it contains an
efficient amount of the restoration filler so as to restore the flowability, degraded by a
maximum of about 10%, up to cone values of above 320 mm, preferably equal to or
above 360 mm, up to 400 mm , that is a restoration to 90% to 100% of the initial

flowability (with no pigment), in that the said fine restoration calcium carbonate filler pertains to the class of fine calcium carbonates characterized by:

0.5 micron < d50 < 5 microns

Preferably 1 micron < d50 < 3 microns

5 90 % < CaCO₃ content < 100 ;

preferably the said fine restoration calcium carbonate filler features :

d50 3 microns CaCO₃ 98.6 % w 100% passing 63 microns sieve Methylene blue test 0.33 g/kg, preferably:

10 90-95-100 % passing 63 microns sieve

d50 < 5 microns

CaCO₃ content of at least 85 pref. at least 90 % weight CaCO₃

15 preferably d50 of 2.8 or 4.3 or 4.0 or 4.8 or 2.8 or 3.0 with respective Blaine surface of (m²/kg) 1018 or 1135 or 942 or 937 or 1022 or 1102, respectively;

and in that the restoration calcium carbonate is a fine GCC or a fine PCC, precipitated calcium carbonate,

20 and preferably the said « restoration » fine calcium carbonate filler is incorporated in a proportion of from 0.1 % up to 5 % by the total weight of the whole cement formulation, preferably from 0.5 % up to 3 % by the total weight of the whole cement formulation, more preferably from 0.5 % up to 2 % by the total weight of the whole cement formulation

25 and in that the base filler is selected among carbonates, calcium carbonates, metakaolin, kaolin, dolomie, fly ashes, « laitiers de ciment », alumino-siliceous fillers, organo-siliceous fillers, and their blends,

and in that the base filler is a GCC calcium carbonate filler featuring the following properties :

D50 5 to 20 microns

preferably 1 to 5 microns

5 Passing 63 microns sieve > 70 %

pref. 100 %

Passing 125 > 85 %

pref. 100%

Passing 2 mm 100 % (both)

10 Blaine surface > 220 m² / kg

pref. > 900 m² / kg

and in that it is preferably a natural product GCC with a high purity and « cleanliness » with :

15 $\text{CaCO}_3 + \text{MgCO}_3 > 90 \%$ with $\text{CaCO}_3 > 65\%$ pref. $\text{CaCO}_3 > 95 \%$

Methylene blue test < 10 g / kg

and in that the color pigment is added at a dosage of 0 – 40 kg/m³, pref. 1 to 5 to 15 – 35 kg/m³ of the whole cement formulation, and an equivalent amount of a solid material such as cement and/or sand, and/or gravel if a concrete, is removed from the « reference cement formulation » preferably in the range of 10 to 35 kg/m³, and preferably 16 and 32 kg/m³ by weight of the whole cement formulation, preferably 16 kg/m³, or 3.9 % by weight of cement.

25 **14. New Use of a fine calcium carbonate** as defined in claims 1 to 13 as a flowability restoration additive in cement compositions comprising a white cement, sand, water, a « base » carbonate, and a pigment.

15. **New Filler PreMix** for cement compositions comprising a white cement, sand, water, a « base » carbonate, and a pigment, characterized in that it consists of a **blend** of the « base » carbonate and of the « fine flowability restoration carbonate », as defined in any of claims 1 to 11, in a ratio of between 5/95 % to 95/5 by weight, preferably 30/70 to 70/30, pref. 40/60 to 60/40 , preferably 50/50, and preferably in a ratio : premix base filler / restoration filler from 256 / 1 by weight to 228 / 8 by weight .
16. **New use of a New filler Premix** for cement compositions comprising a white-or-grey cement, sand, water, a « base » carbonate, and a pigment, consisting of a **blend** of the « base » carbonate and of the « flowability restoration additive » as defined in claims 1 to 11, in a ratio of between 5/95 % to 95/5 by weight, preferably 30/70 to 70/30, pref. 40/60 to 60/40 , preferably 50/50, for the restoration to 90% to 100% of the flowability .
17. **Color Pigment PreMix** for cement formulations characterized in that it comprises a blend of a color pigment with a fine flowability restoration calcium carbonate filler as defined in any of claims 1 to 11, in a ratio of pigment / restoration filler from 1/1 to 5 / 1, by weight, preferably at a ratio by weight of : pigment / restoration filler = 3/1.
18. **New use of the said Color Pigment PreMix** as defined in claim 17 to correct or annihilate the negative impact of the pigment on the flowability and color quality of the cement composition.

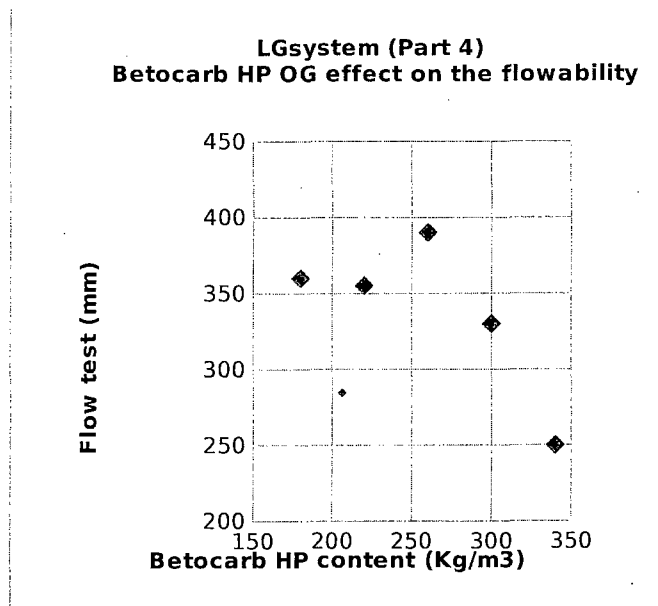


Fig 1A

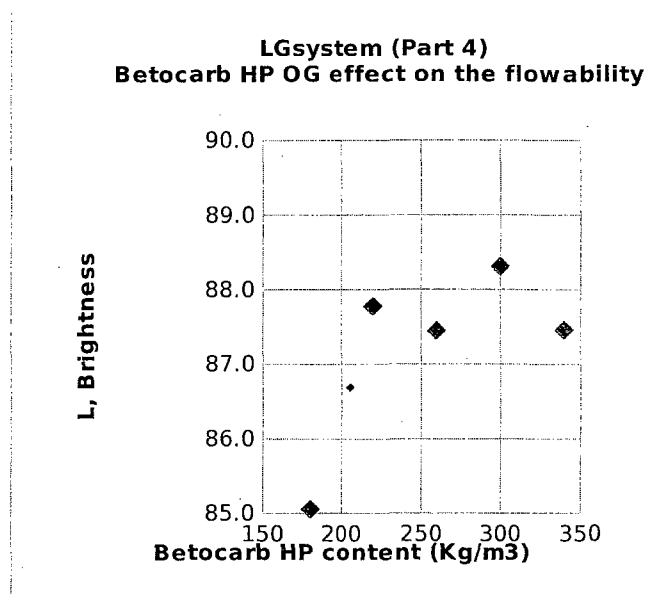


Fig 1B

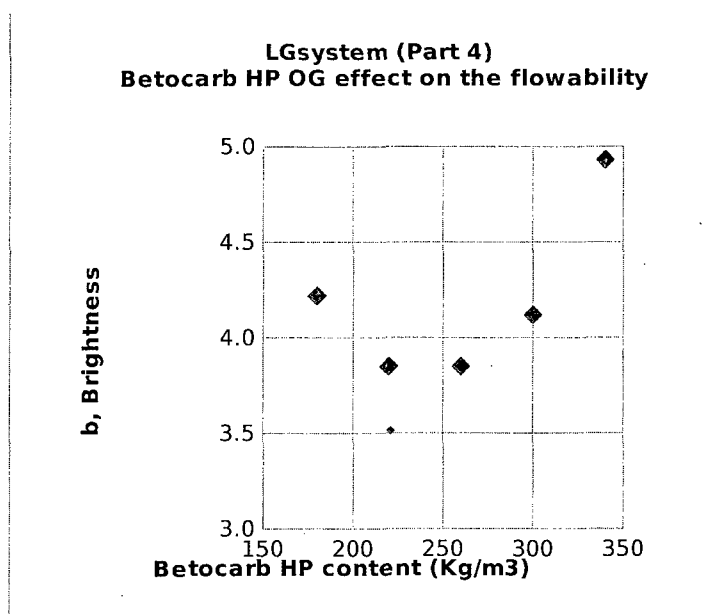


Fig 1C

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L* enhancement with Premium GCC

sub-title

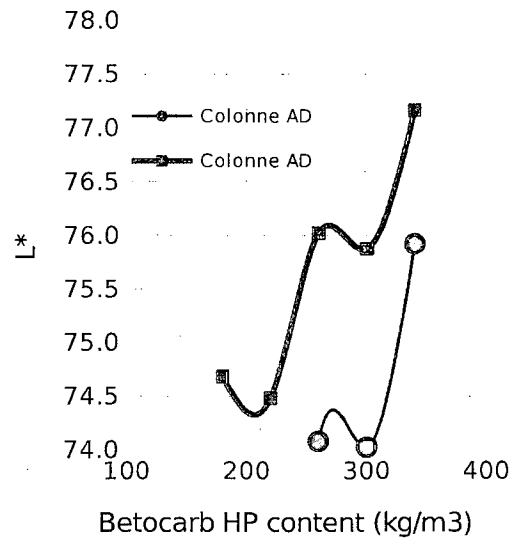


Fig 2A

b* enhancement with Premium GCC

sub-title

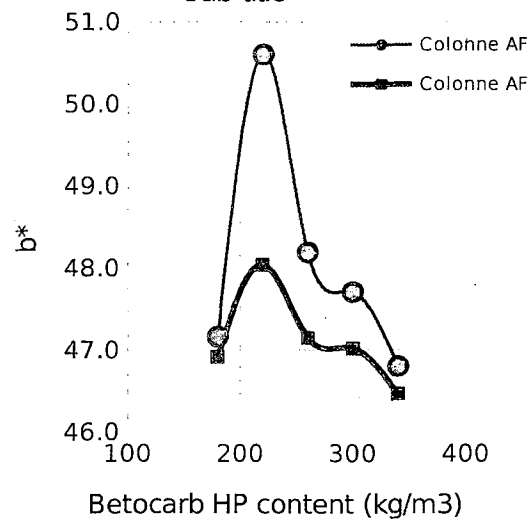
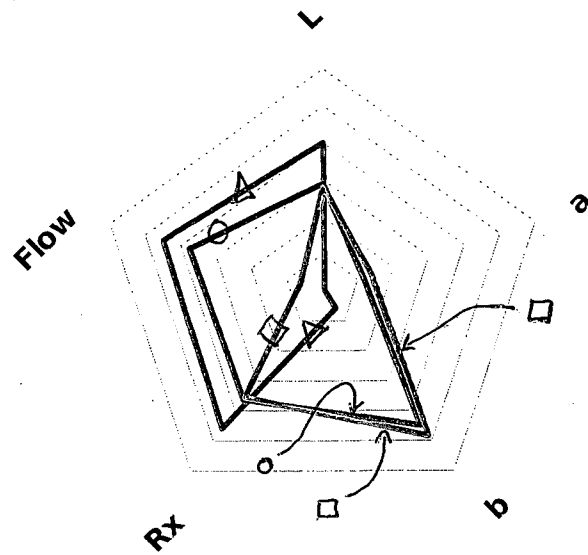


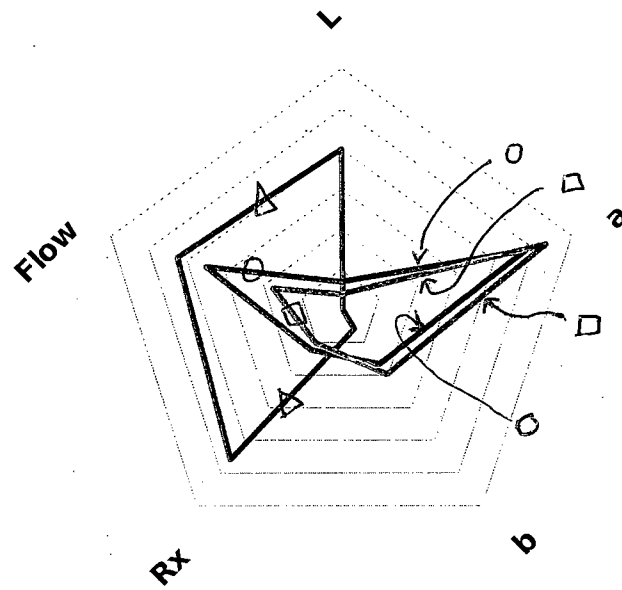
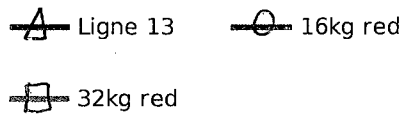
Fig 2B

-  Ligne 13  16kg yellow
 32kg yellow



Feb. 2015

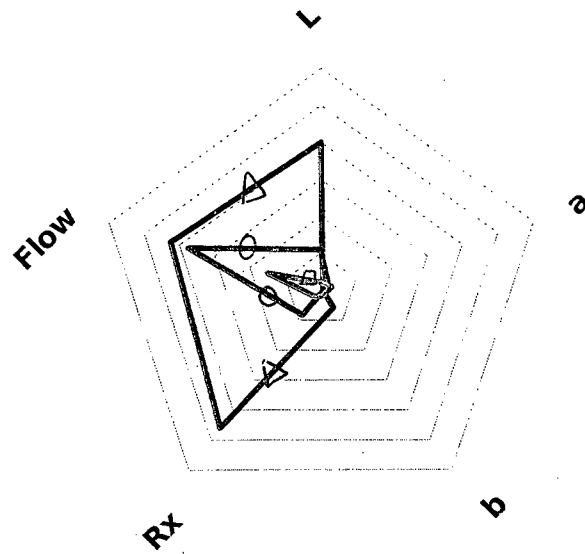
Fig 3



Feb. 2015

Fig 4A

 Ligne 35
  16kg black
 32kg black



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Fig 4B

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L variation

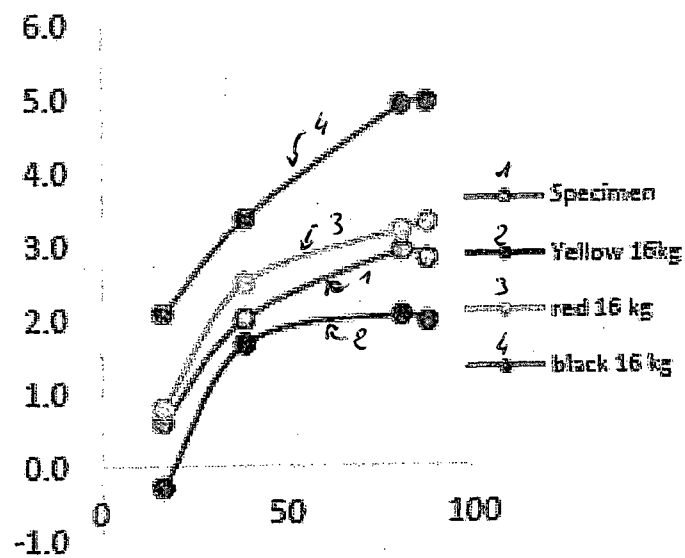


Fig 5A

a variation

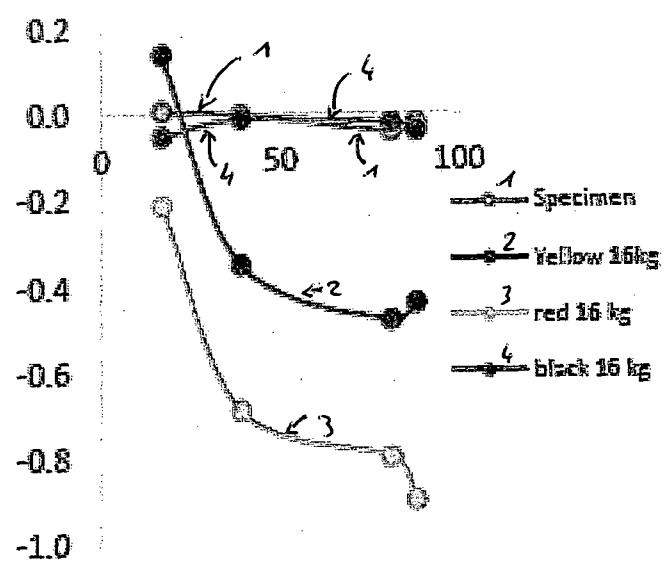


Fig 5B

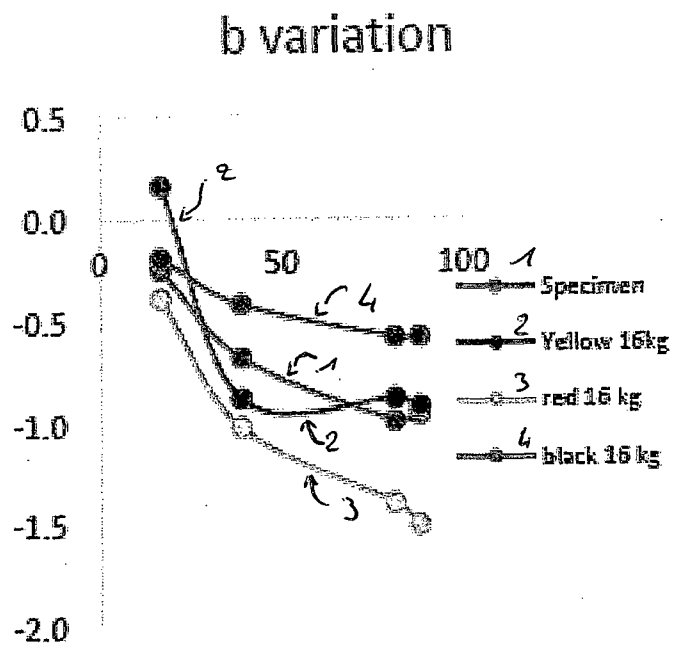


Fig 5C

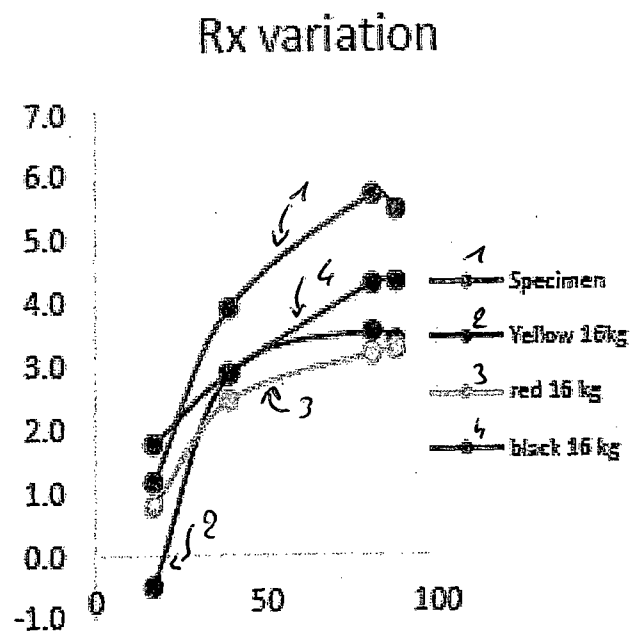


Fig 5D

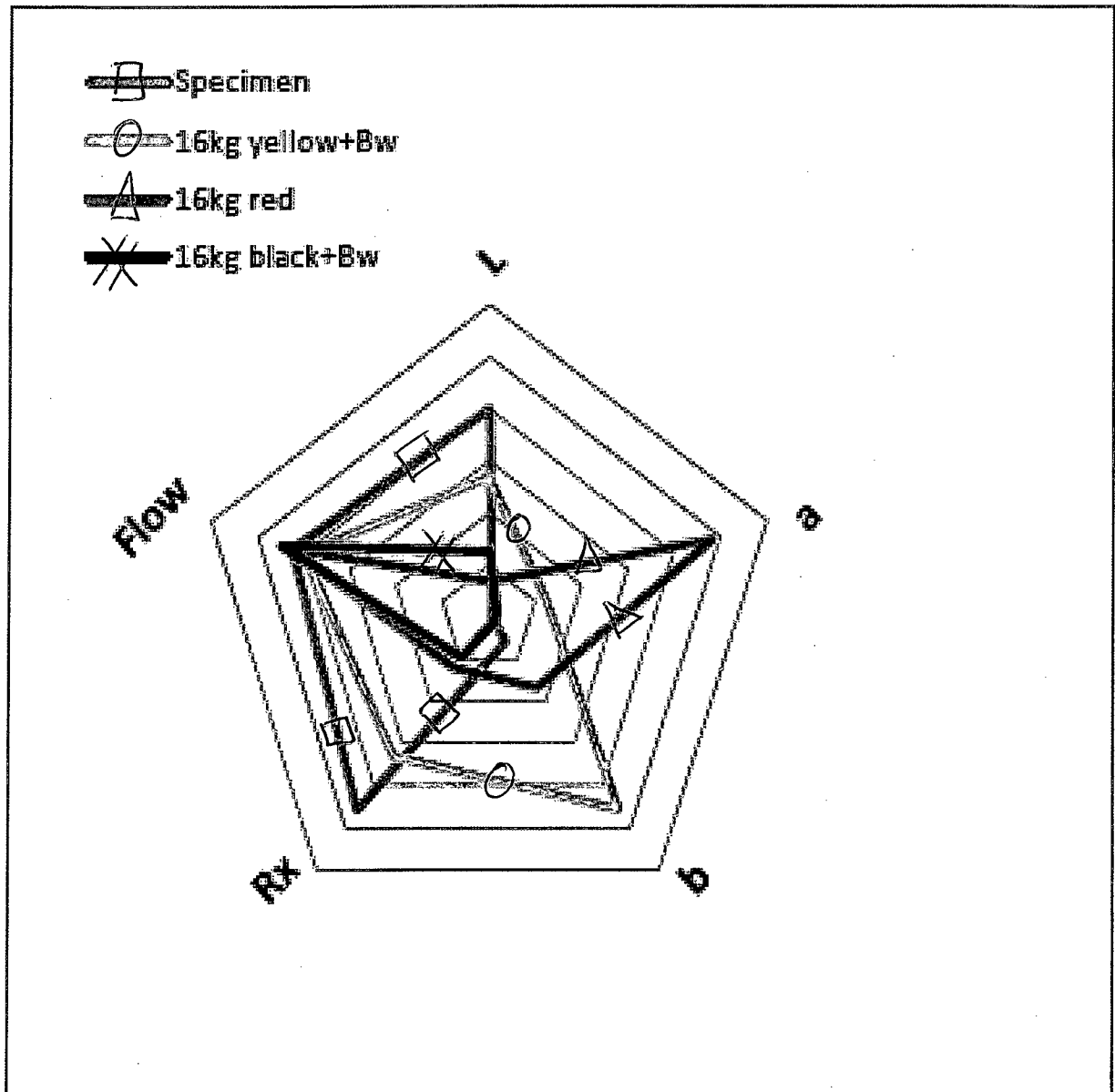


Fig 6

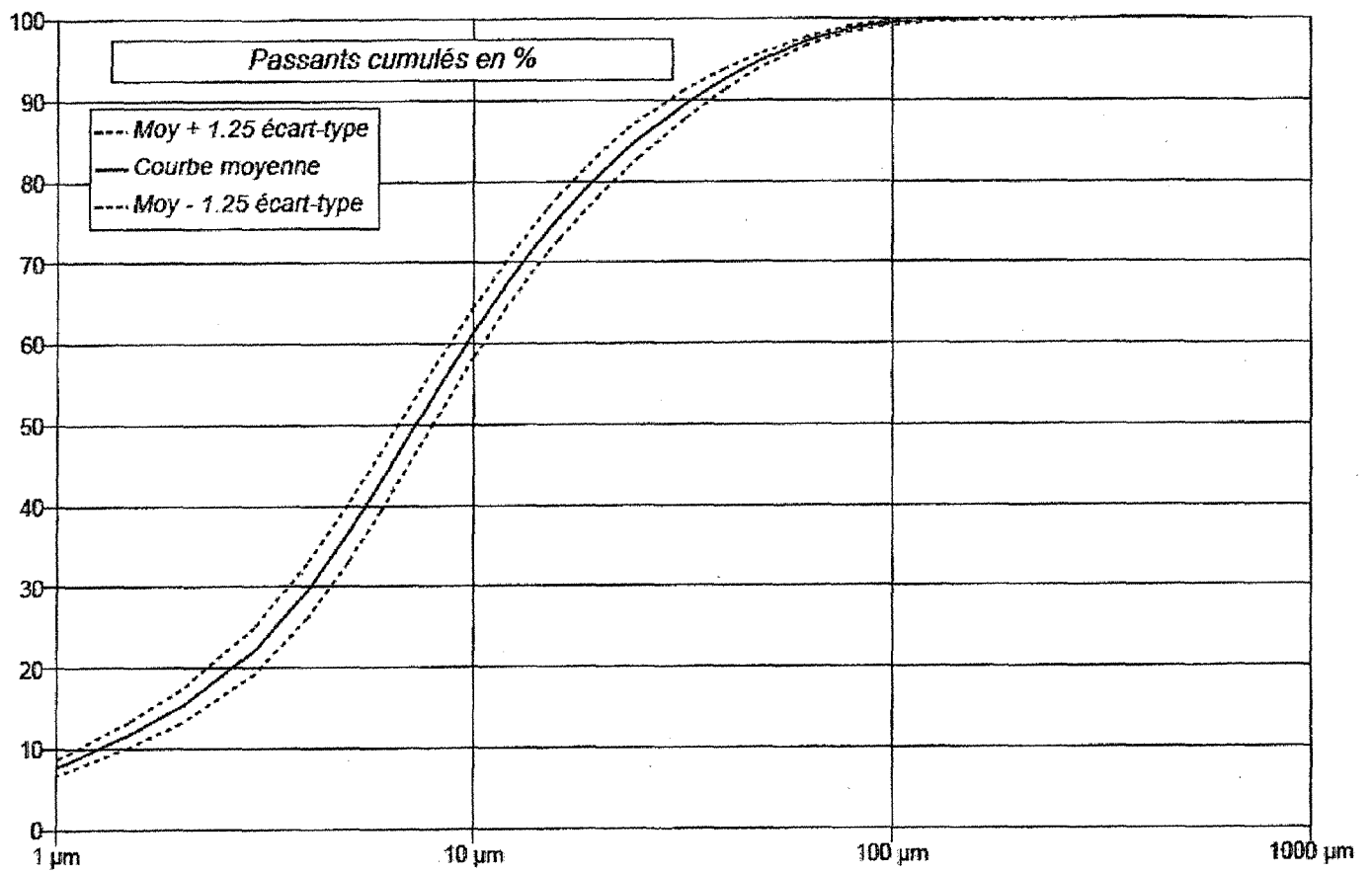


Fig 7

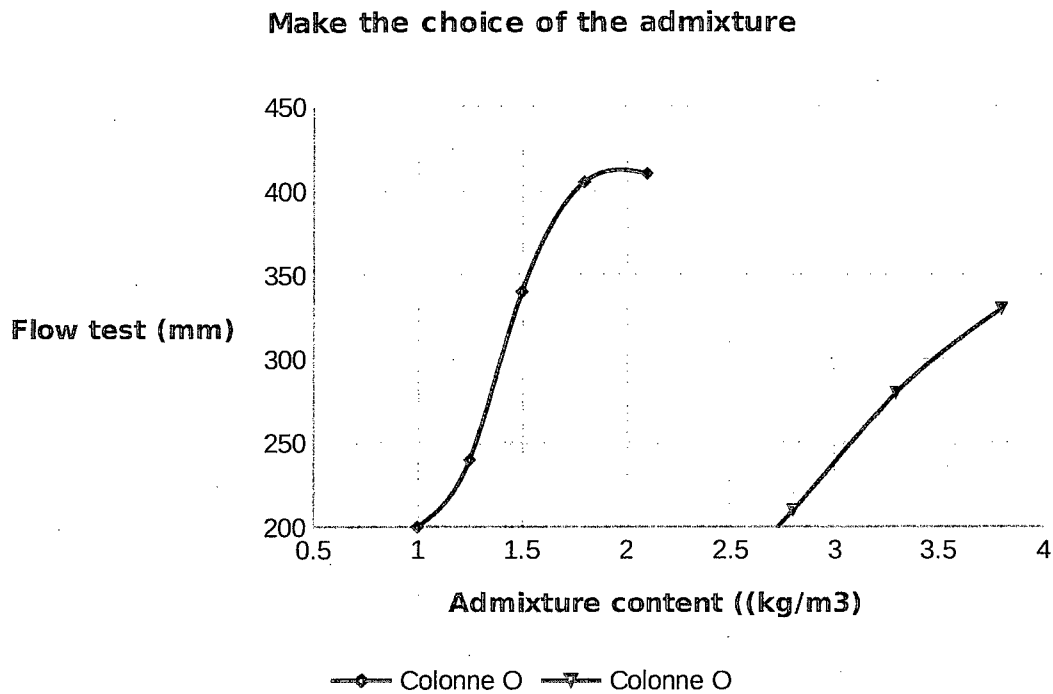


Fig. PTR A1

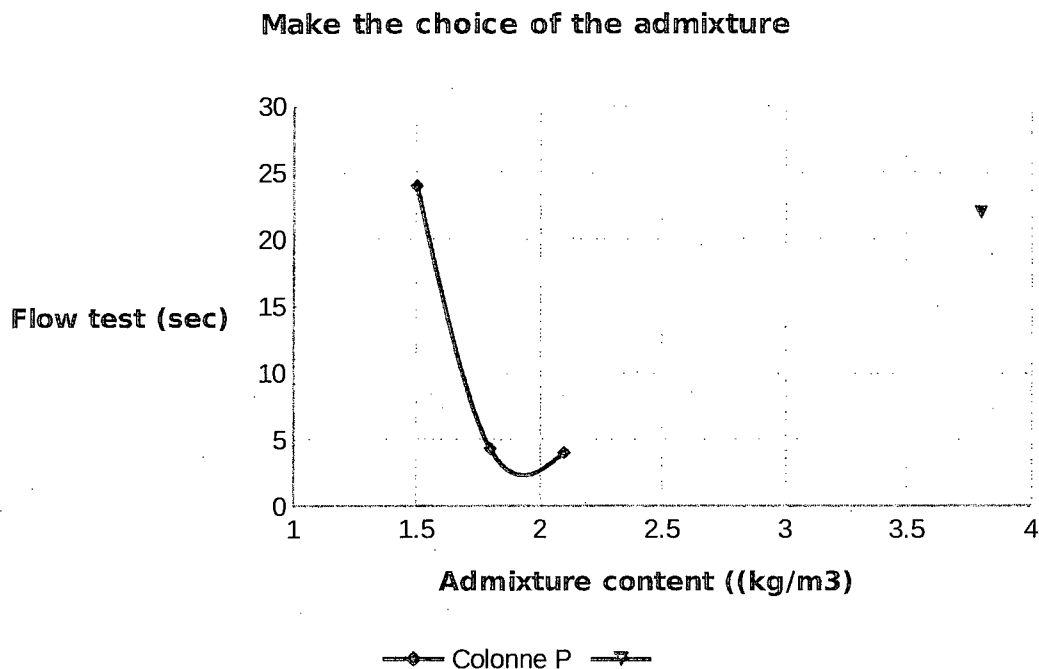


Fig. PTR A2

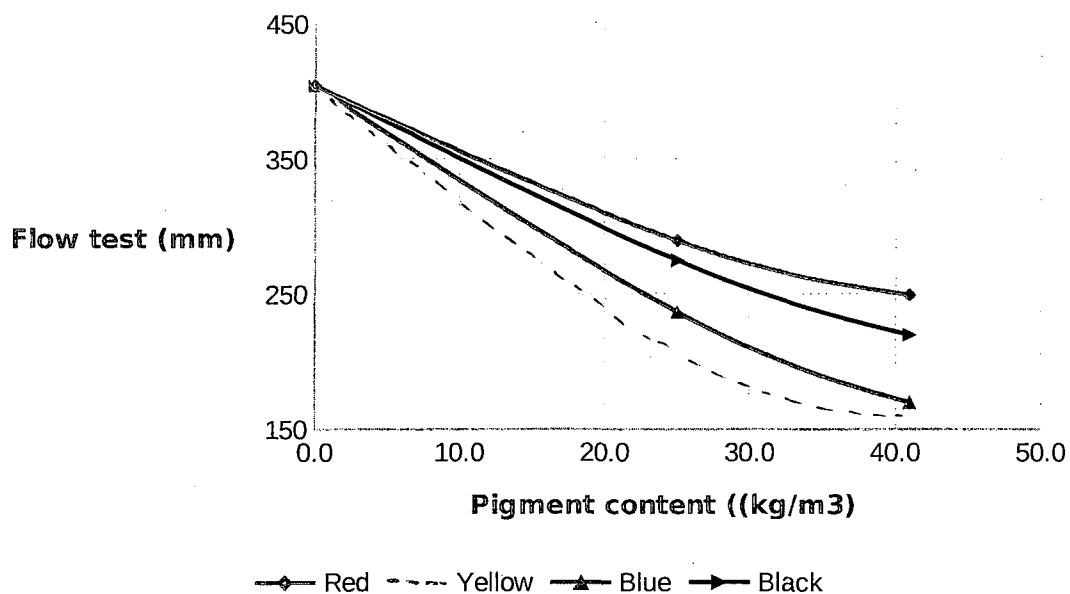
B - Pigment contribution to the flowability

Fig. PTR B1

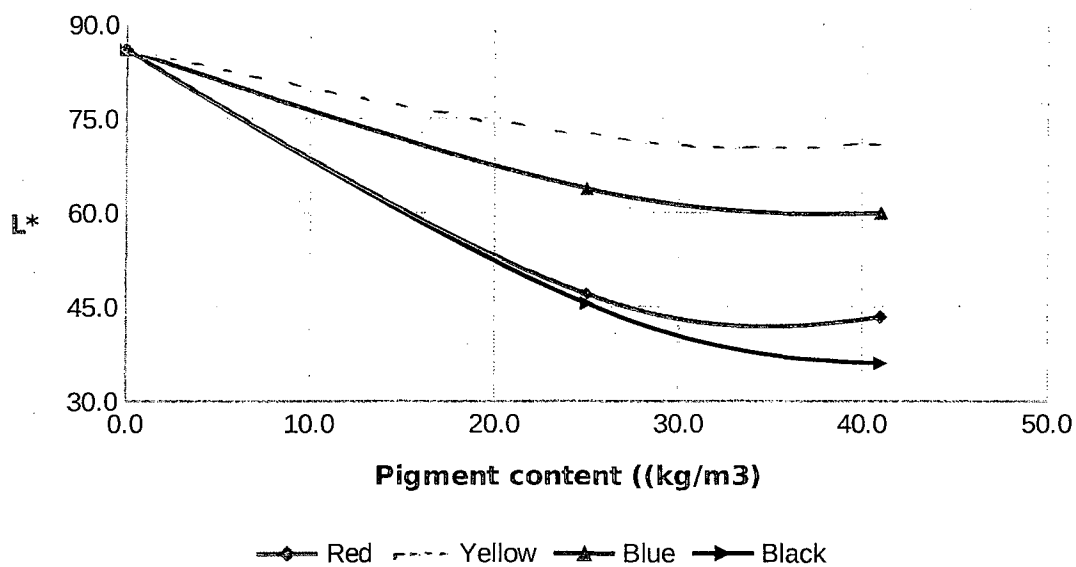
Pigment contribution to L* variation

Fig. PTR B2

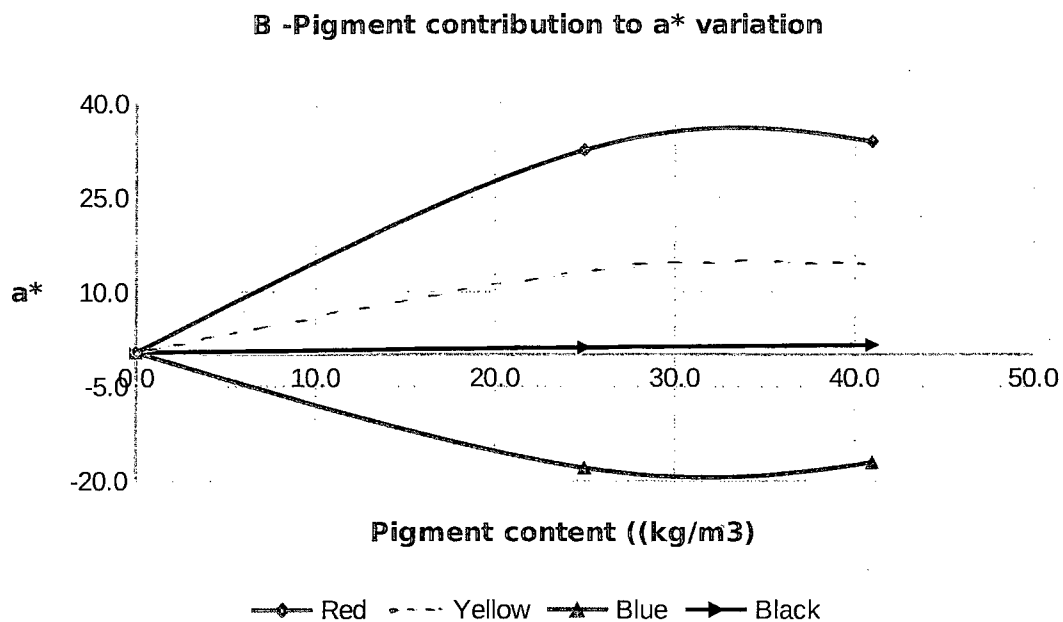


Fig. PTR B3

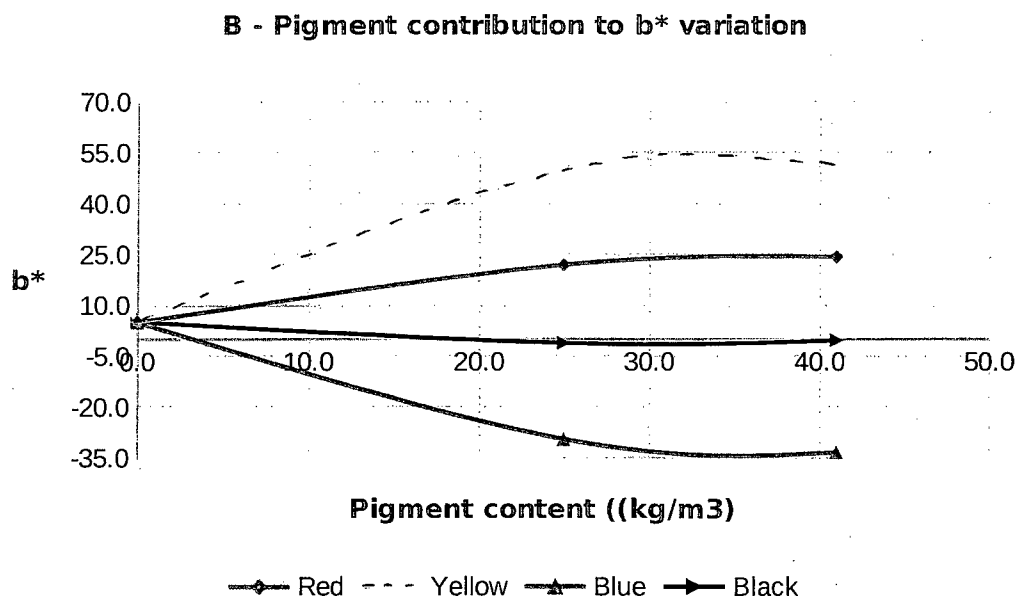


Fig. PTR B4

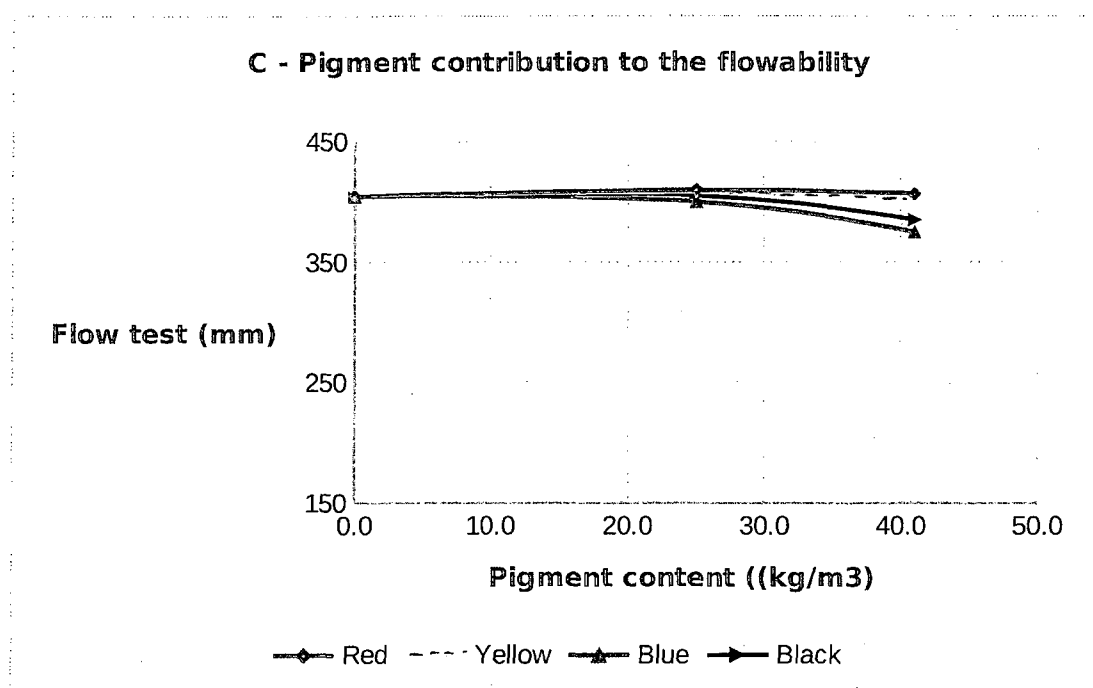


Fig. PTR C1

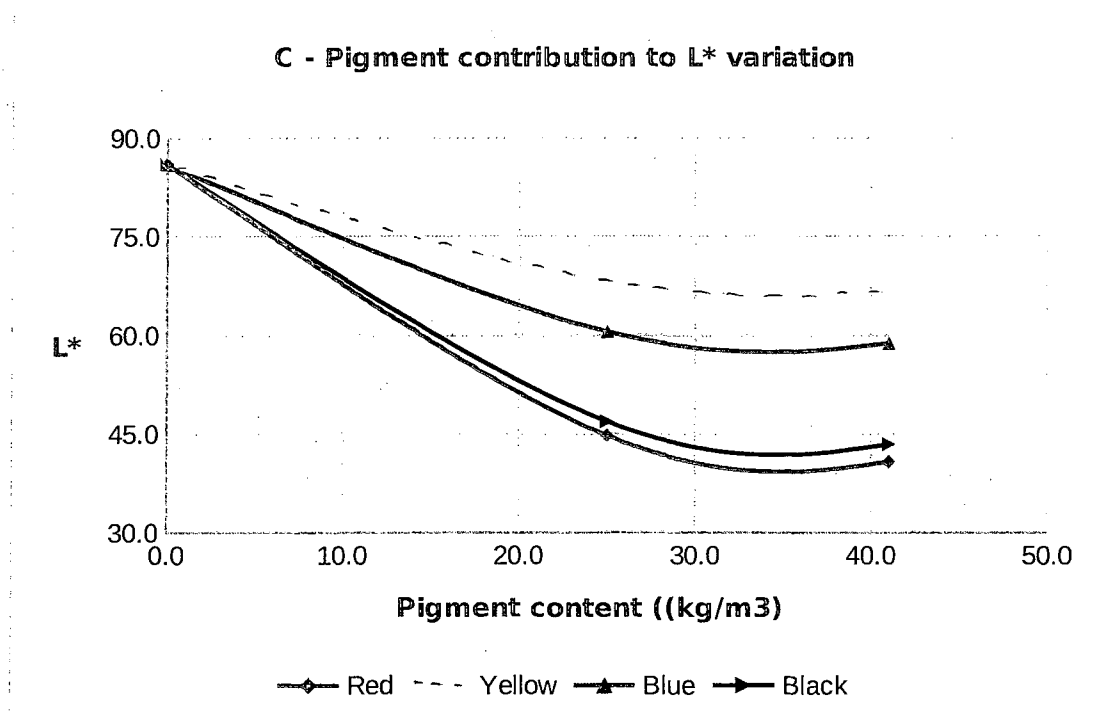


Fig. PTR C2

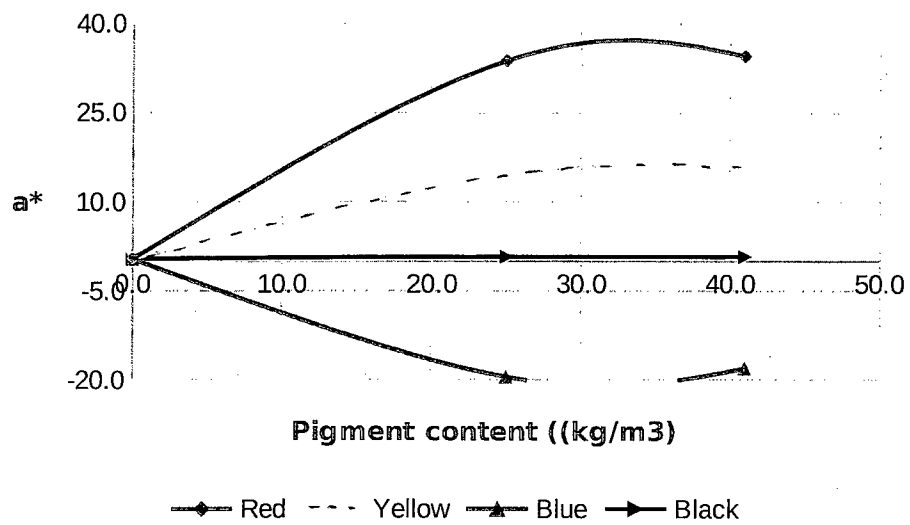
C - Pigment contribution to a* variation

Fig. PTR C3

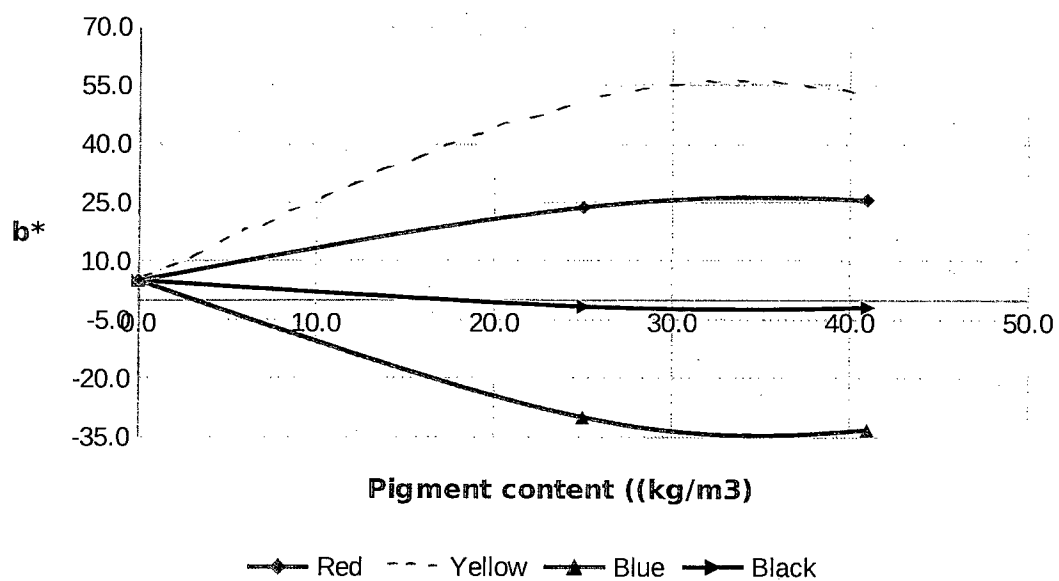
C - Pigment contribution to b* variation

Fig. PTR C4

INTERNATIONAL SEARCH REPORT

International application No
PCT/IB2016/001066

A. CLASSIFICATION OF SUBJECT MATTER

INV. C04B28/04
ADD.

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)

C04B C09C

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 practicable, search terms used)

EPO-Internal, WPI Data, COMPENDEX, INSPEC

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP 2 634 154 A1 (OMYA DEVELOPMENT AG [CH]) 4 September 2013 (2013-09-04) cited in the application "test 1d", "test 2c", "test 3c"; paragraph [0001] - paragraph [0188]; claims 1-31; figure 1; examples 1-3; tables A-E	1-18
A	----- LEE H S ET AL: "Influence of inorganic pigments on the fluidity of cement mortars", CEMENT AND CONCRETE RESEARCH, PERGAMON PRESS, ELMSFORD, NY, US, vol. 35, no. 4, 1 April 2005 (2005-04-01), pages 703-710, XP027645703, ISSN: 0008-8846 [retrieved on 2005-04-01] the whole document ----- -/--	1-18

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

☒ See patent family 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 application or patent 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

13 October 2016

Date of mailing of the international search report

20/10/2016

Name and mailing address of the ISA/

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Authorized officer

Büscher, Olaf

INTERNATIONAL SEARCH REPORT

International application No

PCT/IB2016/001066

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	VALERIA CORINALDESI ET AL: "Influence of inorganic pigments addition on the performance of coloured SCC", CONSTRUCTION AND BUILDING MATERIALS, ELSEVIER, NETHERLANDS, vol. 30, 4 December 2011 (2011-12-04), pages 289-293, XP028458775, ISSN: 0950-0618, DOI: 10.1016/J.CONBUILDMAT.2011.12.037 [retrieved on 2011-12-10] the whole document -----	1-18
A	S. M. Bruce ET AL: "The influence of pigments on mix designs for block paving units", Proc. 4th Int. Conf. Concrete Block Paving, Pave New Zealand '92 (1992), 31 December 1992 (1992-12-31), pages 117-124, XP055238490, Retrieved from the Internet: URL:http://www.icpi.org/sites/default/files/techpapers/43.pdf [retrieved on 2016-01-04] the whole document -----	1-18
A	JANG HONG-SEOK ET AL: "Color expression characteristics and physical properties of colored mortar using ground granulated blast furnace slag and White Portland Cement", KSCE JOURNAL OF CIVIL ENGINEERING, KOREAN SOCIETY OF CIVIL ENGINEERS, HEIDELBERG, vol. 18, no. 4, 25 April 2014 (2014-04-25), pages 1125-1132, XP035317281, ISSN: 1226-7988, DOI: 10.1007/S12205-014-0452-Z [retrieved on 2014-04-25] the whole document -----	1-18
A	US 4 284 546 A (DELFOSSE PIERRE ET AL) 18 August 1981 (1981-08-18) column 1, line 6 - column 6, line 25; claims 1-3; example 1; tables 1-5 -----	1-18
A	DE 40 33 826 A1 (BAYER AG [DE]) 30 April 1992 (1992-04-30) column 1, line 3 - column 4, line 4; claims 1-12; examples 1,2 -----	1-18

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/IB2016/001066

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