

Dark particle dispersion

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The addition of pigments and fly ash to the concrete mix can lead to the separation of dark particles from the mix which effectively float to the top and affect the appearance of the concrete. To counteract this phenomenon, Mapei has developed a new family of products that effectively prevent the separation of such particles in cement mortars and concretes.

The need to disperse dark particles floating in concrete originates when through the addition of fly ash or dark pigments, some of these particles float to the surface and affect the appearance of the hardened surface.

Dark particles floating in concrete

In the practical application of concrete and in construction in general, fly ash is often used as an addition to impart specific durability characteristics to the final product. In some cases, fine particles tend to float to the surface of the concrete. This phenomenon is due to the lower density of fly ash and its lower wettability compared to clinker and gypsum particles. Since this compromises the appearance of the hardened surface, it gives rise to problems.

The same type of situation could also arise with some fly ash-blended cements, depending on the quality of the fly ash used, its amount, particle size distribution, and chemistry. Concrete bleeding (more directly linked to concrete mix design) of course enhances the tendency of the particles to float.

Darker cement

A different type of problem faced by some cement manufacturers is the need to impart a darker colouration to their cement. In some countries a darker hue of the cement is associated to a higher strength. Although this is more of a



Figure 1 above: mortar with one per cent petcoke, no dispersing agent



Figure 2 left: mortar with one per cent petcoke, with Mapei dispersing agent

psychological issue than a real problem (the shade of cement is indeed governed by the amounts of transition elements, having very low impact on actual strength performance), it can be a key selling point in some markets.

To meet this customer requirement, cement manufacturers add a dark pigment during the grinding phase, resulting in a darker colour of the finished product. Different types of darkening agents can be used, depending on factors including the

local availability, cost, ease of use in the plant. However, in some cases, restrictions on the use of certain agents can arise, originating in difficult dispersability of the black powder in mortar or concrete. In practice, this is again the same phenomenon described above, with dark particles floating to the surface of the cementitious product.

In the end, two apparently different problems could have a similar solution: by ensuring that the particles' tendency to float to the surface and agglomerate is counteracted, it is possible to solve them both at the same time.

Mapei's solution

Mapei has developed an innovative product to efficiently prevent separation of small, coloured particles in cement mortars and concretes. This refers to dyeing agents (ie pigments) used to impart a darkening or shading effect to the hardened product, and/or to fine and lightweight powders present in the mix (eg fly ash). Often, these additives contain a fraction of material that tends to float on the surface when the concrete or mortar is placed. This phenomenon is enhanced if the concrete is compacted (eg by vibration), resulting in inaeathetic, irregular spots.

Mapei's product directly acts on the single particles to be dispersed, by promoting their wettability in water (in the specific conditions of concrete batching) and by avoiding their agglomeration. The particles can then be more efficient in their role, being it their more-prompt availability for reaction (eg fly ash) or the action as a colouring agent (eg pigments). This can of course result in a better optimisation in the actual use of the ash or pigment

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addition. Moreover, the dispersing effect of the Mapei additive is not limited by the nature of the particles used to modify the colour of concrete (ie pigments of different colour, particle dimensions, etc). This opens up the possibility to use it for a range of applications relevant to cement colour: from white cement 'whitening agents', to manufacturing of new cements for special purposes ('dyed' concrete and mortars).

The difference made by Mapei's solution can be seen when comparing Figure 1 and 2. Figure 1 shows a mortar where one per cent of petcoke (w/w vs. cement) was added to impart to the cement a darker hue, with no other addition besides water and sand. It can be seen that petcoke clearly separates from the mix upon compaction with a jolting table (EN 196-1 type). Petcoke particles agglomerate on the surface, giving irregular, big spots.

Figure 2 shows the same mortar, but with the addition of Mapei dispersant (dosage of 500g/t of cement). It is immediately apparent that no separation can be seen, that the overall shade of the mortar is darker, and that the petcoke is completely incorporated and dispersed in the mortar.

Mapei manufactures its dispersing agent in both liquid and powder form, offering the option for the final user to add it in the cement mill as a standard grinding aid (in liquid form) or to dry-mix it after grinding (powder form).
