A high-quality filler

Precipitated calcium carbonate for exterior paints.
Wilhelm Lüdecke, Gerd Aumann

Alongside of talc, kaolin and mica calcium carbonate is the most important filler for emulsion paints both for inside as well as outside applications. In it's ground form it comes to market as GCC (ground calcium carbonate) in various different qualities. A calcium carbonate in a finer crystal structure (meaning particle sizes of 0.2 to 0.3µm) showing an improved set of properties can only be produced in a chemical precipitation process. The various different precipitation processes are sufficiently known from literature [1,2]. Currently the direct process, burning limestone >900°C with natural gas in order to ensure purity, slaking the quick lime and precipitating the calcium carbonate (PCC-"precipitated" calcium carbonate) by introducing CO₂ into the milk of lime is the most profitable and common.

Two crystal forms can be produced

Depending on the production process precipitated calcium carbonate can be produced in calcite or largely aragonite crystal form. The most important and thus the most significant tests, in particular for its use in paints, are summarised in DIN EN ISO 3262-6. PCC is used in the paint and lacquer industry predominantly in emulsion paints. Preferred qualities have a particle diameter of 0.2 to 0.3µm that is optimal for its light scattering abilities and that constitutes the best compromise with regard to brightness, opacity, low sheen in matt paints, tendency to mud cracking, abrasivity in combination with coarser fillers (packing density) and TiO₂ (space holding effect) [3]. For inside and outside paints PCC has for years proven to be a high-quality filler. Nonetheless the use of PCC, particularly in outside paints, has until now remained a question of "philosophy" in individual cases; on one side it was believed that PCC having such fine particles should show increased chalking, in particular with high water steam permeable paints with a pigment volume concentration of around 60, and on the other side some paint manufacturers refrained from using calcium carbonate, ground or precipitated, at all in outdoor paints, since ultimately at the time when acid rains was an issue in some industrial regions pH readings around 4 were being recorded that for years time when acid rains was an issue in some industrial regions pH readings around 4 were being recorded that for years time when acid rains was an issue in some industrial regions pH readings around 4 were being recorded that for years time when acid rains was an issue in some industrial regions pH readings around 4 were being recorded that for years time when acid rains was an issue in some industrial regions pH readings around 4 were being recorded that for years time when acid rains was an issue in some industrial regions pH readings around 4 were being recorded that for years time when acid rains was an issue in some industrial regions pH readings around 4 were being recorded that for years time when acid rains was an issue in some industrial regions pH readings around 4 were being recorded that for years time when acid rains was an issue in some industrial regions pH readings around 4 were being recorded that for years

used. The accelerated weathering exercises conducted (Xenotest, 1840 hours) indicated a tendency to results comparable to those of outdoor weathering and will therefore not be discussed further. In outside weathering after five years (Figure 2) it emerges very clearly that with styrene-acrylate even with 20% PCC no increased chalking can be observed while with vinyl-propionate increased chalking is observed at 15% PCC. In Figure 3 the paints' tendency to chalk with and without 10% PCC is shown over a period of ten years. Apart from the vinyl acetate copolymers that is not suitable for outside use the paints show the same tendency to chalk with or without 10% PCC.

Several years of weathering experiments on polysiloxane paints have shown that PCC contents of 10% show an even more favourable chalking progression than corresponding paints without PCC. These results were confirmed independently by other paint laboratories. Weathering exercises over the very long period of more than ten years show that contents around 10-12% Socal not only provide facade paints with greater brightness and opacity but thanks to better packing density of PCC with 5µm GCC products do not increase the tendency to chalk as well as reducing the tendency to crack (mud cracking). In facade paints PCC has by now become a permanent component of paint formulations.

References
1) J. Dedek, Le Carbonate de chaux, Librairie Universitaire, Louvain 1966
3) Socal - Herstellung, Eigenschaften, Anwendung, Solvay, Rheinberg 1992

The authors:
- Dipl. Ing. Wilhelm Lüdecke is Sales Manger for synthetic Calciumcarbonate in Solvay.
- Dr. Gerd Aumann works for the Technical Marketing in the BU "Advanced Functional Minerals" of Solvay.

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Figure 1: Brightness and opacity at different PCC contents, using various binders.

Figure 2: Chalking of paints with different PCC contents after five years of weather exposure. Chalking scale: 10 - no chalking.

Figure 3: Chalking of paints without and with 10% PCC after ten years' weather exposure. Chalking scale: 10 - no chalking.