

PRECURSOR STRUCTURES IN CRYSTALLIZATION AND PRECIPITATION AND CONTROL OF PARTICLE FORMATION BY POLYMERS

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Crystallization of inorganic (and organic) matter often proceeds via intermediate stages – rather than by simple nucleation and growth mechanisms.^[1] These precursor stages not only comprise crystal modifications that are less stable than the final one (Ostwald's rule of stages), but also amorphous, hydrated (nano-) particles and emulsion-like precursors have been observed.^[2-4] These precursors tend to aggregate or restructure before being dissolved and entering the next structural stage.

Structural information on all these intermediates – and by which mechanisms they form – is essential for the development of additives to control crystallization processes – either to achieve particles with a certain size distribution, with certain functionalities or “simply” to impede crystallization in water treatment processes such as seawater desalination.

Our state of knowledge with respect to precursor structures that occur in inorganic particle formation processes from the aqueous phase is outlined. Emphasis is put on how to obtain time-resolved data by combining microscopic and scattering methods. Most of the studies presented focus on the reaction of calcium and carbonate in water and the mode of action that polycarboxylates play during the formation of calcium carbonate precursors and crystals. Some examples concerning the precipitation of AlO(OH) (boehmite, a catalyst support), the organic pigments chinacridone and the hydration reactions of cement phases will also be addressed.

Recent data on the structural evolution of precipitating CaCO₃ obtained by means of X-ray microscopy and quench cryo-transmission electron microscopy will be presented, again emphasizing that the respective particle formation processes do not follow classical nucleation and growth mechanisms.^[5]

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