



Modulation of the early pre- and post-nucleation stages of scale forming minerals by a commercial copolymer

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Mineral precipitation is a substantial hazard for multiple technological applications, leading frequently to the formation of thick scale deposits that can completely block fluid circulation in different industrial processes. Polymeric scale inhibitors are commonly used to mitigate or retard these unwanted mineral precipitation reactions. Here we study the mechanisms by which a commercial copolymer of maleic acid/allyl sulfonic acid with phosphate groups (MASP), commonly used in the oil recovery industry, modulate the precipitation of two common scale forming minerals, calcite and barite. We found that MASP does not significantly affect the equilibrium of pre-nucleation aggregates in both systems, while it seems to prevent the aggregation of prenucleation associates by incomplete stabilization, thereby inhibiting (at least temporarily) the nucleation of a solid phase. Moreover, it influences polymorph selection in the CaCO_3 , as in the presence of this additive nucleation occurs at high supersaturation via amorphous calcium carbonate that later transform into calcite, while in control runs (i.e. no MASP present) the direct formation of vaterite is observed.