Effects of Magnesium and Polyaspartic Acid on Calcium Carbonate Formation

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Carbonate scale formation may cause high costs during the maintenance of tunnel drainage systems, boilers, heat exchangers and oil field wells. The application of chemical inhibitors such as magnesium and polyaspartic acid can change the precipitation behaviour and retard the precipitation. Experimental studies are required to decipher the reaction kinetics and mechanisms of inhibition and finally to retard carbonate scaling efficiently by the addition of chemical inhibitors.

In the present study the effects of magnesium and polyaspartic acid during spontaneous calcium carbonate precipitation has been evaluated by experiments using a screening method, mixing approach, and CO_2-diffusion technique (e.g. Tang et al., 2008). During all experiments the evolution of the water chemical composition as well as that of the solids were analysed. The results show that the induction time increases with increasing magnesium and polyaspartic acid concentration. Elevated Mg^{2+} concentrations induce the formation of fine spicular aragonite crystals with lengths between 3 and 10 μm, while relatively huge calcite crystals of about 15 to 40 μm in diameter are produced at low Mg^{2+} content. In the presence of polyaspartic acid vaterite is preferentially formed. The evolution of foreign element distribution in the calcium carbonate precipitates can provide insight into the precipitation mechanisms using different inhibitor agents. Moreover, the reaction kinetics is successfully modelled using PHREEQC (Parkhurst and Appelo, 1999).

References

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