

3D morphology of barium sulfate particles precipitated in the presence of a commercial copolymer

The morphologies of barite particles collected after the conductivity experiments are shown in Fig. 1. Control precipitates (formed in the absence of inhibitor) have rectangular, pillow shapes reported by other authors (e.g. Jones et al., 2002), with a homogeneous size distribution and an average size of $4 \times 2 \mu\text{m}$.

When 0.25 ppm of inhibitor was added to the growth solution, the shape of the particles was not modified but single crystals tended to form aggregates, and the average size of the individual crystals decreased to $\sim 500 \text{ nm} \times 250 \text{ nm}$ (Fig. 1a). These particles do not look smooth on the surface like the control particles obtained without inhibitor, but present a rough surface with a 'layer' attached on different faces of the barite precipitates. The barite particles are around eight times smaller and the number of particles obtained was greater than the number achieved when grown in the absence of inhibitor. An increase in the amount of inhibitor in the solution (0.5 ppm) resulted in the formation of large aggregates of particles that individually mostly retain the pillow shape ($300 \text{ nm} \times 200 \text{ nm}$) (Fig. 1b). Some aggregates also began to exhibit rounded and irregular shapes at this concentration of inhibitor. In the presence of 1 and 2 ppm inhibitor, the shape of the barite particles changed dramatically (Fig.1). The rectangular, pillow-shaped crystals began to appear as aggregates of rounded particles with a diameter ranging from 50 to 150 nm. No differences in EDX analysis between control particles and particles obtained in the presence of the inhibitor were detected. To detect any incorporation of inhibitor into the precipitated particles, further analysis is required, but was beyond the scope of the present work.

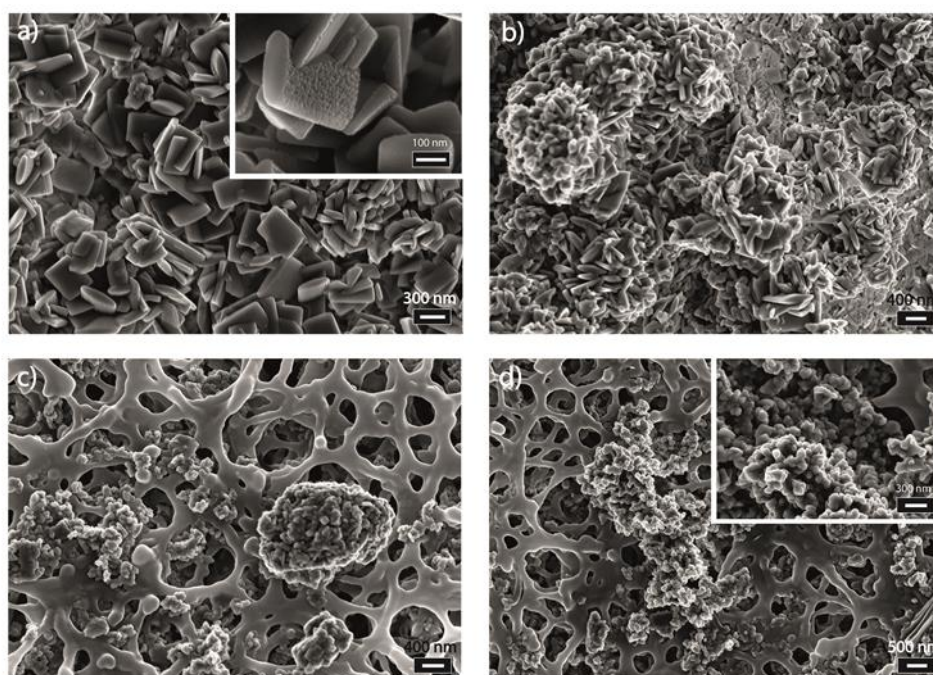


FIG. 1. FESEM images of barium sulfate particles obtained after conductivity experiments in the presence of commercial inhibitor. The concentration of barium sulfate was 250 mM in all the experiments: (a) + 0.25 ppm inhibitor; (b) +0.5 ppm inhibitor; (c) +1 ppm inhibitor; (d) + 2 ppm inhibitor. Note the growth modifications occurring with increasing amounts of copolymer inhibitor.