

#20

POLYASPARTIC ACID AS A CLEANING AGENT FOR CALCITE AND BARITE DEPOSITS

Jonathan Braxton, Brian Crow & Christine S. Grant*

Department of Chemical Engineering, North Carolina State University, Box 7905, Raleigh, NC, USA

ABSTRACT

Due to low solubility at high temperatures, mineral salts such as BaSO_4 , CaPO_4 , and CaSO_4 form deposits which cause cleaning problems in a number of areas. The scaling and fouling of process machinery and piping reduces the overall production efficiency in the dairy and oil production industries. Organic agents have been used as replacements for hydrochloric/sulfuric acids and more toxic inorganics in the dissolution of both calcite and calcium containing minerals. Chelating agents have arisen as an environmentally friendly alternative to other organic cleaners such as phosphates and polyacrylates. Sodium polyaspartate has been found to enhance the removal of HAP/DCPD deposits from stainless steel during turbulent flow under alkaline conditions. Research by our group demonstrated that the environmentally benign polymer, polyaspartic acid (PASP) as a possible cleaning agent for calcium based deposits. The results of calcium mineral experiments can be extended to barium compounds.

This study seeks to determine the mechanism of PASP attack on BaSO_4 and the optimum operating conditions to increase the dissolution of scaling minerals in industrial processes. Controlled mass transfer rotating disk and batch dissolution experiments provide both kinetic rate and chemical information. The dissolution of naturally occurring barite is a function of polymer concentration, pH, and polymer molecular weight. Atomic Absorption (AA) spectroscopy determines mineral dissolution rates through evaluation of the bulk liquid. Ex situ Scanning Electron Microscopy (SEM) and Atomic Force Microscopy (AFM) provide insight into morphological changes of polished surfaces due to interfacial interactions of PASP with BaSO_4 . AFM also suggests uniform layer by layer dissolution of the orthorhombic barite crystal structure in PASP at long dissolution times.

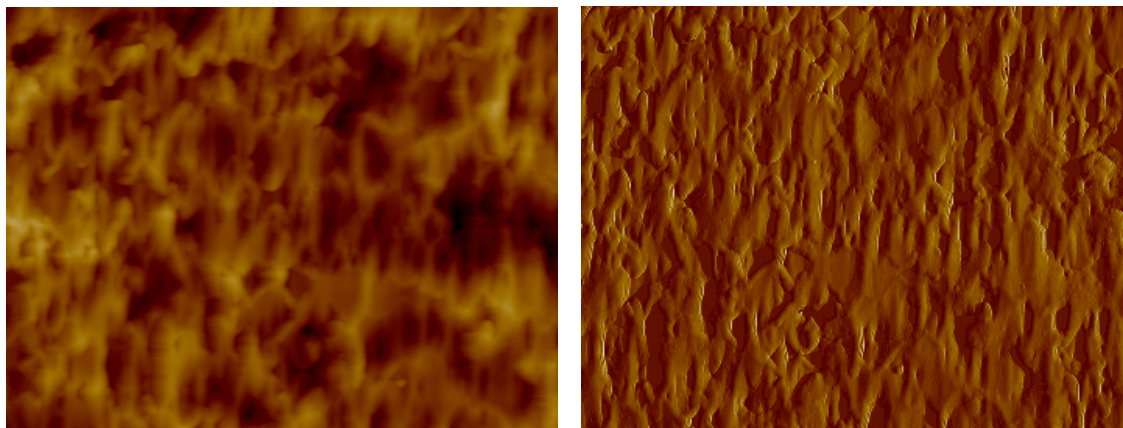


Fig. 5x5 μm AFM image of barite crystal after 20hr dissolution by 0.1M PASP.