

Interaction of phosphate-bearing solutions with gypsum: Epitaxy and induced twinning of brushite ($\text{CaHPO}_4 \cdot 2\text{H}_2\text{O}$) on the gypsum cleavage surface

ANDRÉ JORGE PINTO, AMALIA JIMENEZ,* AND MANUEL PRIETO

Department of Geology, Universidad de Oviedo, Jesús Arias de Velasco s/n, 33005 Oviedo, Spain

ABSTRACT

Under slightly acidic conditions and 25 °C, the interaction between phosphate-rich aqueous solutions and gypsum cleavage fragments results in the surface precipitation of brushite ($\text{CaHPO}_4 \cdot 2\text{H}_2\text{O}$) crystals, which grow epitaxially on the (010) surface of gypsum. Using an *A*-centered unit-cell setting for both brushite (*Aa*) and gypsum (*A2/a*), the epitaxial relationship implies matching of the planes (010) of both structures and correspondence between equivalent crystallographic directions within these planes. The crystal habit of the overgrowing brushite is thin tabular to laminar on {010} with $\{11\bar{1}\}$ and $\{111\}$ as side faces and a clear elongation on [101]. There are two orientations of the brushite plates on the gypsum surface related to each other by a twofold axis on [010]. Thus, the overgrowth is an aggregate of parallel brushite crystals that may be twin-related, with the twofold axis as the twin law. During the interaction, gypsum dissolution is coupled with brushite growth until saturation with respect to both minerals is reached. A model of this thermodynamically driven dissolution-crystallization process is presented using the geochemical code PHREEQC. The epitaxial relationships are explained by comparing the bond system and the crystallographic properties of both minerals.

Keywords: Phosphate, gypsum, epitaxy, twinning