From nano to micropillar formation on calcite via ammonium chlorite etching to enhance hydrophobicity

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Abstract

This work presents an innovative idea to achieve hydrophobicity through anisotropic dissolution of calcite by ammonium chloride. In recent decades, the knowledge of the wettability, physical and chemical properties of the surface of materials have become a trending topic.

In the past, it has been possible to obtain micro-pillars on the surface of calcite for transdermal application in the medical field, but it has never been seen at the nanoscale how structures are formed, and which is the effect that these pillars may have on the wettability modification of the surface of calcite itself. In this work, arrays of iso-oriented calcite pillars about 20 μm in undersaturated aqueous calcium solution were formed. The ordered structure of pillars adds surface roughness, resulting in the increase of its contact angle.

The first few instants of anisotropic dissolution, studied with AFM, were focused on in this research. In addition, the roughness was tested by confocal microscope, and the physics of water droplet formation at different humidity fits on the calcite surface was solved at ESEM by condensation studies through saturation-evaporation cycles at the surface. To observe the hydrophobic behavior, the static contact angle was used.

The possibility of a surface that is more durable against weathering therefore can be achieved by the building structures to prevent water coming into direct contact with the surface. These insights provide the first hazards of obtaining a longer-lasting surface of an industrial material without the application of coatings.