

The dissolution of laumontite in acidic aqueous solutions: A controlled-temperature in situ atomic force microscopy study

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ABSTRACT

The behavior of the zeolite laumontite during dissolution in acidic aqueous solutions has been studied by fluid-cell atomic force microscopy, with a focus on the role of the framework Al atoms in controlling the dissolution mechanisms. Isothermal single etch pits dissolution rates have been measured in situ at three different temperatures (11, 23, and 40 °C) on the (110) surface, and at one temperature (22 °C) on ($\bar{2}01$). The experimentally derived apparent activation energy of the development of the etch pits ($E = 11.9 \pm 4$ kJ/mol) on the (110) surface and their morphology can be interpreted considering the structural features of laumontite, especially the crystallochemical distribution of the Al atoms in the framework. Preliminary comparison of the dissolution features of laumontite with those measured on zeolites with different Si/Al ratios and Al distribution further confirm the controlling role of the structural Al in the dissolution process.

Keywords: In situ AFM, dissolution process, laumontite, mineral surfaces, etch pit