

Solid state NMR study of oxygen site exchange and Al-O-Al site concentration in analcime

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ABSTRACT

Oxygen isotope exchange between natural analcime and water vapor at low pressure is studied by ^{17}O NMR, which can distinguish Si-O-Si and Si-O-Al sites and provide information on site specific exchange kinetics and mechanisms. Si-O-Al sites in analcime are found to exchange faster than Si-O-Si sites at lower temperature (400 °C). At higher temperature (500 °C), the exchange rates for the two types of site are similar, suggesting that the exchange process for Si-O-Si has a higher activation energy, as predicted by published theoretical calculations. The overall exchange reaction appears to be controlled largely by reaction at sites, not diffusion. Static ^{17}O spectra show an anomalously high ratio of Si-O-Si to Si-O-Al sites, suggesting the presence of a few percent of Al-O-Al sites, which are indeed resolved and observed in triple quantum magic-angle spinning (3QMAS) spectra.