American Mineralogist, Volume 99, pages 671–680, 2014

Infrared absorption spectroscopy of SiO_2-moganite

Ming Zhang[1,2,*] and Terry Moxon[3]

[1]Frontier Institute of Science and Technology, Xi'an Jiaotong University, 710054, Xi'an, China
[2]Department of Earth Sciences, University of Cambridge, Downing Street, Cambridge CB2 3EQ, U.K.
[3]55 Common Lane, Auckley, Doncaster DN9 3HX, U.K.

Abstract

Moganite, a newly approved mineral, is microcrystalline silica. Samples of microcrystalline silica varieties containing variable amounts of moganite have been analyzed using absorption infrared spectroscopy (IR). The main spectral differences between moganite and α-quartz occur in the wavenumber region below 650 cm^{-1}. Above this wavenumber, the frequencies of Si-O stretching vibrations of moganite are almost identical to those of quartz. Additional moganite bands were recorded near 165, 207, 296, 343, 419, 576, and 612 cm^{-1}, and several of these extra IR bands have been identified for the first time in moganite. The results indicate that moganite and quartz have different crystal structures and symmetries in terms of different tetrahedral linkages. Infrared spectra obtained from samples with different moganite contents cannot be simply explained by mechanical mixing of the two moganite and quartz end phases. The change in moganite content leads to not only a variation of spectral intensity, but also a systematic modification in band position and full-width at half maximum. This unusual behavior is attributed to grain size, strains, and stacking faults in moganite and the intergrowth of moganite with fine-grained quartz. The close correlation between band width and moganite content is indicative of an improved crystallinity with decreasing in moganite concentration that has been identified in natural quartz variations. The results imply that moganite may play a role in the formation or crystallization of microcrystalline quartz. The present IR application offers a new method to estimate the moganite content in microcrystalline silica varieties.

Keywords: Moganite, SiO_2, infrared spectroscoy, phonon modes, quartz