American Mineralogist, Volume 98, pages 78–84, 2013

Thermal infrared and Raman microspectroscopy of moganite-bearing rocks

Craig Hardgrove* and A. Deanne Rogers

Department of Geosciences, Stony Brook University, 255 Earth and Space Sciences Building (ESS), Stony Brook University, Stony Brook, New York 11794-2100, U.S.A.

Abstract

We present the first thermal infrared reflectance spectral characterization of moganite and mixtures of moganite with microcrystalline quartz. We find that for relatively high (>50%) abundances of moganite, the absolute reflectance for samples is significantly reduced. Using microscopic-Raman (~1 μm/pixel) measurements, we estimate the moganite content for various samples. We then compare Raman-derived moganite abundances with microscopic infrared reflectance (25 μm/pixel) spectra to determine the effects of increasing moganite abundance on thermal infrared spectra. We find that moganite is broadly spectrally similar to quartz with major reflectance maxima located between ~1030 and 1280 cm^{-1} and ~400 and 600 cm^{-1}; but there are characteristic differences in the peak shapes, peak center positions, and especially the relative peak reflectance magnitudes. For regions with high (>50%) moganite content, the relative magntitudes of the reflectance maxima at 1157 and 1095 cm^{-1} (R_{1095}/R_{1157} band ratio) can be used to estimate the moganite content. This work demonstrates the utility of thermal infrared microspectroscopy in isolating phases that are intimately mixed in a sample, and has applications in planetary science, where constituent phases of quartz-rich sedimentary rocks can be identified using remote or in situ thermal infrared spectroscopy.

Keywords: Moganite, chert, microcrystalline quartz, silica, Raman spectroscopy, infrared spectroscopy, microspectroscopy, Mars