American Mineralogist, Volume 90, pages 1100–1107, 2005

The visible and infrared spectral properties of jarosite and alunite

JANICE L. BISHOP[1,2,*] AND ENVER MURAD[3]

[1]SETI Institute, 515 North Whisman Road, Mountain View, California 94043, U.S.A.
[2]NASA-Ames Research Center, Mail Stop 239-4, Moffett Field, California 94035, U.S.A.
[3]Bayerisches Geologisches Landesamt, D-95603 Marktredwitz, Germany

ABSTRACT

The visible and infrared spectral properties of two natural jarosite minerals and a suite of synthetic jarosites and alunite samples are described here. The fundamental stretching and bending vibrations observed in the infrared region for SO_4^{2-} and OH^- are compared with the near-infrared overtones and combinations of these vibrations. Shifts were observed in the SO_4^{2-} and OH^- bands for Al^{3+} vs. Fe^{3+} at the octahedral sites and K^+ vs. Na^+ at the "A" (frequently monovalent) sites. Crystal-field theory bands were observed for jarosite near 435, 650, and 900–925 nm and were compared to those of iron oxides. Spectral bands near 1.76, 2.17, 2.53, 4.5, 8–10, and 15–24 μm (corresponding to ~5670, 4600, 3970–4150, 2100–2300, 1000–1225, and 420–675 cm^{-1}, respectively) for alunite and near 0.43, 0.91, 1.85, 2.27, 2.63, 4.9, 8–10, and 15–24 μm (corresponding to ~23 000, 10 990, 5400, 4350–4520, 3800–4150, 1950–2200, 1000–1190, and 440–675 cm^{-1}, respectively) for jarosite would be most useful for detecting these minerals using remote sensing on Earth or Mars. These minerals are important indicators of alteration processes, and this study contributes toward combined visible/near-infrared and mid-infrared spectral detection of these two alunite-group minerals.