American Mineralogist, Volume 101, pages 423–430, 2016

Interpretation of the infrared spectra of the lizardite-nepouite series in the near- and mid-infrared range

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Abstract

A series of 1:1 silicate clays of the lizardite-nepouite series [$Si_2Mg_{3-x}Ni_xO_5(OH_4)$ with x = 0, 0.5, 1, 1.5, 2, 2.5, and 3] was synthesized at 220 °C during 7 days from coprecipitated gels in hydrothermal conditions. A clear relationship was evidenced between the *d*(06–33) and the Ni/Mg ratio of the synthesized samples following a Vegard's law and suggested a random distribution of octahedral cations. For the first time, infrared spectra of this series were given in both near and mid-infrared spectral regions (250–7500 cm^{-1}). Notably, the bands due to the OH stretching vibrations and those of their first overtones in the lizardite-nepouite series were attributed. The combination bands observed in the near infrared region for both end-members could be attributed thanks to combinations of two or three middle-infrared features. Some of the observed combination bands are clearly linked to combination of different vibrational groups.

Infrared spectroscopy is simple to use and is a powerful tool to study the crystal chemistry of garnierites. More broadly, the improvement of band attributions especially in near infrared contributes to develop the infrared analyses in field geology and remote sensing.

Keywords: Lizardite, nepouite, infrared spectroscopy, near infrared, mid-infrared, synthesis, nickel, clay minerals, serpentine, phyllosilicates, garnierite