

SPINELS RENAISSANCE: THE PAST, PRESENT, AND FUTURE OF THOSE UBIQUITOUS MINERALS AND MATERIALS

Raman spectroscopy and the inversion degree of natural Cr-bearing spinels

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ABSTRACT

Natural Cr-spinels previously characterized by X-ray single-crystal diffraction and electron microprobe have been analyzed by Raman spectroscopy. The results we report show that there is a strong correlation between the Cr/(Cr+Al) ratio (Cr#) and the A_{1g} mode for the studied spinels. A strong correlation of this mode with Mg/(Mg+Fe²⁺) (Mg#) can be seen only for spinels with Mg# higher than 0.60. Other modes can increase, decrease or disappear depending on the Cr#. Among the spinels with low Cr# it is possible to define their order/disorder degree. In fact, spinels with an inversion degree lower than 0.14 show an E_g mode at about 400–410 cm⁻¹, while spinels with Cr# higher than 0.20 register the appearance of a peak in the region 150–200 cm⁻¹, while other peaks are substituted by smooth curves. The results show that the use of Raman applied to spinel in provenance studies cannot yield a 100% confidence because of the uncertainties in the relation between Mg# and the different modes.

Keywords: Raman spectroscopy, natural spinels, order/disorder, provenance study