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Feasibility of determining the quantitative OH content of garnets with Raman spectroscopy

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ABSTRACT

Two suites of garnets were examined by infrared absorption spectroscopy and depolarized Raman spectroscopy to determine if the Raman signal could be used as a quantitative measurement of OH content. To avoid the problems of determining the absolute Raman signal intensity, the integrated intensity of the OH bands was ratioed to the integrated intensity of silicate Si-O stretching bands and used as a proxy for the OH intensity. These were compared to the OH contents, expressed as wt% H_2O, independently determined from infrared absorption. A somewhat useful trend developed between OH contents determined by Raman and IR for some grossular garnets with H_2O contents less than 0.5%. Many colorless to near-colorless grossular garnets do not provide a useful Raman signal due to fluorescence, although other samples with H_2O contents between 0.5 and 1.3 wt% and are strongly colored, fall far below the trend of the samples with lower H_2O-contents. Spessartine-almandine garnets from the Rutherford no. 2 pegmatite all respond to the Raman experiment, but produce a confusing trend when compared to H_2O. Coincidentally, a relatively smooth but decreasing trend was observed when the spessartine Raman OH intensity ratio was compared to the iron content. These observations suggest that Raman measurements by this method are not suitable, in general, for the determination of OH in garnets.