

Spectroscopic studies of spessartine from Brazilian pegmatites

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ABSTRACT

Mössbauer spectra (MS) at room temperature (RT) and Fourier-transform infrared (FTIR) spectra in the OH stretching region were acquired for natural spessartine-almandine garnet samples from different Brazilian pegmatites, including the complex, zoned Alto Mirador pegmatite, the simple, zoned Escondido pegmatite, and the simple Poaiá pegmatite. From MS, it is obvious that in the samples from the Alto Mirador pegmatite, ferrous iron is present at the dodecahedral site and ferric iron at the octahedral site of the garnet structure. The Fe²⁺/Fe³⁺ ratio is comparable for all samples from this pegmatite, i.e., ~10%, implying the same geological history, namely similar oxygen fugacities at the moment of garnet formation. In the simple pegmatites, however, almost no ferric iron was detected. On the basis of the multi-band FTIR spectra the nature of the point defects involved in the process of hydrogen uptake in spessartine-almandine garnet has been elucidated, if not completely clarified. The behavior of the absorption bands provides no evidence for multiple incorporation mechanisms, hence the hydrogarnet substitution is proposed to be the only mechanism for the incorporation of hydrogen in the samples studied. As geological setting is difficult to separate from chemical composition, FTIR spectra have the potential to provide useful information on some aspects of the geological history of the samples.