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A Rietveld and infrared study of synthetic amphiboles along the potassium-richterite–tremolite join

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ABSTRACT

Amphiboles were synthesized at 750° C, 1 kbar (H_2O) for compositions at 20% intervals along the join potassium-richterite–tremolite. Structural variations, site occupancies, and modal analyses of the experimental products (amphibole + minor diopside, quartz, and enstatite) were characterized by Rietveld structure refinement, with final R_{Bragg} indices in the range 4–6%, and by infrared spectroscopy in the principal OH-stretching region. Amphibole compositions were determined by (1) site-scattering refinement for the A and M4 sites that are occupied by (K, □) (□ = vacancy) and (Na,Ca), respectively; and (2) mass-balance calculations involving the modal analysis and the nominal experimental product composition. These measurements agree within 1% absolute and show close agreement with electron-microprobe compositions for the two samples that we could analyze. Deviations from nominal amphibole composition are up to 19% absolute. The resulting relations between cell dimension and composition are linear. The major change in cell dimensions is a decrease of 0.25 Å in *a* with increasing tremolite component.

The infrared spectra show two principal peaks at 3735 and 3675 cm^{-1}, corresponding to the local arrangements MgMgMg-OH-^{A}K (the Kr band) and MgMgMg-OH-^{A}□ (the Tr band), respectively. The relative variation in peak intensity as a function of amphibole composition shows that the molar absorptivities of the two bands are significantly different. The ratio of the molar absorptivities for the two bands is 2.2.