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Enthalpy of formation of katoite $Ca_3Al_2[(OH)_4]_3$: Energetics of the hydrogarnet substitution

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ABSTRACT

The silicon-free end member of the hydrogrossular solid solution series, katoite $Ca_3Al_2[(OH)_4]_3$, was synthesized in a solid-media, piston-cylinder apparatus. The enthalpy of formation from the component oxides was measured by high-temperature oxide melt calorimetry and found to be $\Delta H_f = -255.6 \pm 12.2$ kJ/mol; the resulting enthalpy of formation from the elements is $\Delta H_f = -5551.5 \pm 16.4$ kJ/mol. From this value, enthalpies for breakdown reactions of hydrogrossular were calculated and the relative energetic stability of katoite evaluated.