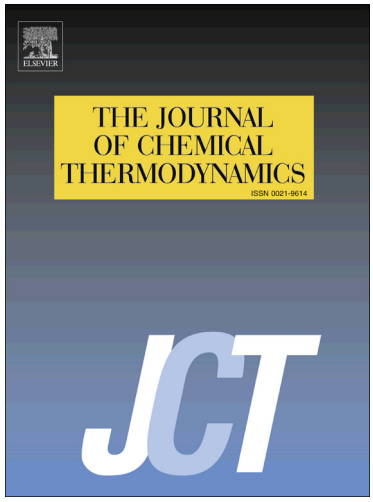

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Thermodynamic properties of phosphate members of the meta-autunite group: a high-temperature calorimetric study

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ABSTRACT

Samples of synthetic analogs of uranyl phosphate minerals have been prepared at room temperature by slow mixing of reactants by a diffusion method. Reaction products were analyzed using powder X-ray diffraction (PXRD), thermogravimetric analysis (TGA), inductively coupled plasma optical emission spectrophotometry (ICP-OES), and inductively coupled plasma mass spectrometry (ICP-MS). Calorimetric measurements have been performed in a Calvet-type twin calorimeter using sodium molybdate ($3Na_2O$-$4MoO_3$) solvent at 976 K as a flux. The enthalpy of formation from the binary oxides, $\Delta H_{f\text{-}ox}$, at 298 K was calculated for each compound from the respective drop solution enthalpies, ΔH_{ds}. Calculated standard enthalpies of formation from the elements, ΔH^0_f, at 298 K are -3425 ± 9 kJ/mol for meta-ankoleite (KUP), -6233 ± 17 kJ/mol for meta-autunite (CaUP), -6921 ± 13 kJ/mol for metatorbernite (CuUP), -7254 ± 17 kJ/mol for meta-saléeite (MgUP), -3264 ± 12 kJ/mol for Rb-meta-autunite (RbUP), -3580 ± 7 kJ/mol for metanatro-autunite (NaUP), -3692 ± 11 kJ/mol for Li-meta-autunite (LiUP), -