

The new K, Pb-bearing uranyl-oxide mineral kroupaite: Crystal-chemical implications for the structures of uranyl-oxide hydroxy-hydrates

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ABSTRACT

Kroupaite (IMA 2017-031), ideally $\text{KPb}_{0.5}[(\text{UO}_2)_8\text{O}_4(\text{OH})_{10}] \cdot 10\text{H}_2\text{O}$, is a new uranyl-oxide hydroxyl-hydrate mineral found underground in the Svornost mine, Jáchymov, Czechia. Electron-probe micro-analysis (WDS) provided the empirical formula $(\text{K}_{1.28}\text{Na}_{0.07})_{\Sigma 1.35}(\text{Pb}_{0.23}\text{Cu}_{0.14}\text{Ca}_{0.05}\text{Bi}_{0.03}\text{Co}_{0.02}\text{Al}_{0.01})_{\Sigma 0.48}[(\text{UO}_2)_{7.90}(\text{SO}_4)_{0.04}\text{O}_{4.04}(\text{OH})_{10.00}] \cdot 10\text{H}_2\text{O}$, on the basis of 40 O atoms apfu. Sheets in the crystal structure of kroupaite adopt the fourmarierite anion topology, and therefore kroupaite belongs to the schoepite-family of minerals with related structures differing in the interlayer composition and arrangement, and charge of the sheets. Uptake of dangerous radionuclides (⁹⁰Sr or ¹³⁵Cs) into the structure of kroupaite and other uranyl-oxide hydroxy-hydrate is evaluated based on crystal-chemical considerations and Voronoi-Dirichlet polyhedra measures. These calculations show the importance of these phases for the safe disposal of nuclear waste.

Keywords: Kroupaite, new mineral species, uranyl-oxide hydroxy-hydrate, crystal structure, Voronoi-Dirichlet polyhedral, ¹³⁵Cs; ⁹⁰Sr; Jáchymov