

Adolfpateraite, $K(UO_2)(SO_4)(OH)(H_2O)$, a new uranyl sulphate mineral from Jáchymov, Czech Republic

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ABSTRACT

Adolfpateraite, monoclinic $K(UO_2)(SO_4)(OH)(H_2O)$, is a new supergene mineral from the Svornost mine, Jáchymov ore district, Czech Republic. It forms sulfur yellow to greenish yellow crystalline aggregates, up to 2 mm in diameter. Crystals are transparent to translucent with a vitreous luster, without observable cleavage. The streak is pale yellow. The Mohs hardness is ~2. The mineral shows a green fluorescence in long-wave ultraviolet radiation. Adolfpateraite is pleochroic, with α = colorless and γ = yellow (β could not be examined). It is biaxial, with $\alpha = 1.597(2)$, $\gamma = 1.659(2)$ (β could not be measured), birefringence 0.062. The empirical chemical formula (mean of 4 electron microprobe point analyses) was calculated based on 8 O apfu and is $K_{0.94}(UO_2)_{1.00}(SO_4)_{1.02}(OH)_{0.90}(H_2O)_{1.00}$ (water content calculated). The simplified formula is $K(UO_2)(SO_4)(OH)(H_2O)$, requiring K_2O 10.70, UO_3 64.97, SO_3 18.19, H_2O 6.14, total 100.00 wt%. Adolfpateraite is monoclinic, space group $P2_1/c$, $a = 8.0462(1)$, $b = 7.9256(1)$, $c = 11.3206(2)$ Å, $\beta = 107.726(2)^\circ$, $V = 687.65(2)$ Å³, $Z = 4$, and $D_{\text{calc}} = 4.24$ g/cm³. The five strongest reflections in the X-ray powder diffraction pattern are [d_{obs} in Å (1) (hkl): 7.658 (76) (100), 5.386 (100) (002), 5.218 (85) ($\bar{1}02$), 3.718 (46) (021), 3.700 (37) ($\bar{2}02$). The crystal structure has been refined from single-crystal X-ray diffraction data to $R_1 = 0.0166$ with $GOF = 1.30$, based on 1915 observed reflections [$I_{\text{obs}} > 3\sigma(I)$]. The crystal structure consists of chains of uranyl polyhedra extended along [010], with OH^- located on the shared vertex between the bipyramids. The sulfate tetrahedra decorate the outer side of the chain with bridging bidentate linkages between the uranyl pentagonal bipyramids. H_2O groups are located on the edges of the chains on the non-linking vertex of each uranyl pentagonal bipyramid. K^+ atoms are located between the chains providing additional linkage of these together with H-bonds. The fundamental vibrational modes of uranyl ion, sulfate tetrahedra, and H_2O groups were tentatively assigned in the infrared and Raman spectra. The new mineral is named to honor Adolf Patera (1819–1894), Czech chemist, mineralogist, and metallurgist.

Keywords: Adolfpateraite, uranyl sulfate, crystal structure, chemical composition, Jáchymov