

New data on uranyl sulphate mineral shumwayite from Jáchymov - a Raman spectroscopy study

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Abstract

Jáchymov (Czech Republic) is the second locality of hydrated uranyl-sulphate mineral shumwayite in the world. Shumwayite occurs as rich dark orange crystalline coatings composed of crystals - thin elongated blades up to 100 μm in size, but usually as thin tables only of about 20 μm in size, on strongly weathered fragment of gangue. It is associated with rietveldite, rozenite and as yet unnamed Al-uranyl sulphate, uranyl phosphate and Fe-Zn uranyl sulphate-vanadate. Individual shumwayite crystals are translucent to transparent with vitreous lustre. It does not exhibit fluorescence under either long- or short-wave ultraviolet radiation. The quantitative chemical composition of shumwayite sample is in line with the ideal stoichiometry of $\text{UO}_2:\text{SO}_4 = 1:1$; but also minor contents of Fe and Zn were identified. Shumwayite is monoclinic, the space group $P2_1/c$, with the unit-cell parameters refined from X-ray powder diffraction data: a 6.738(2), b 12.482(5), c 16.865(6) Å, β 91.00(3)° and V 1418.3(7) Å³. Raman spectroscopy documented the presence of both $(\text{UO}_2)^{2+}$ and $(\text{SO}_4)^{2-}$ units in the crystal structure of shumwayite. Multiple bands connected with vibrations of water molecules suggest that molecular water is involved in different coordination environments in the structure of shumwayite with distinct hydrogen-bond strengths.

Key words: shumwayite, uranyl sulphate, unit-cell parameters, chemical composition, Raman spectroscopy, Jáchymov ore district

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