

Hydrothermal synthesis and crystal chemistry of the new strontium uranyl selenites, $\text{Sr}[(\text{UO}_2)_3(\text{SeO}_3)_2\text{O}_2]\cdot 4\text{H}_2\text{O}$ and $\text{Sr}[\text{UO}_2(\text{SeO}_3)_2]$

PHILIP M. ALMOND AND THOMAS E. ALBRECHT-SCHMITT*

Department of Chemistry, Auburn University, Auburn, Alabama 36849, U.S.A.

ABSTRACT

The reaction of UO_3 with SeO_2 in the presence of $\text{SrCl}_2\cdot 6\text{H}_2\text{O}$ and $\text{Sr}(\text{OH})_2\cdot 8\text{H}_2\text{O}$ in supercritical water at 425 °C for 3 d results in the formation of the new strontium uranyl selenites, $\text{Sr}[(\text{UO}_2)_3(\text{SeO}_3)_2\text{O}_2]\cdot 4\text{H}_2\text{O}$ (1) and $\text{Sr}[\text{UO}_2(\text{SeO}_3)_2]$ (2). The single crystal X-ray structures of type 1 and type 2 were solved by direct methods and refined by full-matrix least-squares methods. Crystallographic data (193 K): (1), monoclinic, space group $C2/m$, $a = 17.014(2)$, $b = 7.0637(7)$, and $c = 7.1084(7)$ Å, $\beta = 100.544(2)^\circ$, $Z = 2$, $R(F) = 0.0361$ for 79 parameters with 1132 reflections with $I > 2\sigma(I)$, $wR_2 = 0.0998$ for all data; (2), triclinic, space group $P\bar{1}$, $a = 5.6722(4)$, $b = 6.7627(5)$, and $c = 11.2622(8)$ Å, $\alpha = 104.698(1)^\circ$, $\beta = 93.708(1)^\circ$, $\gamma = 109.489(1)^\circ$, $Z = 2$, $R(F) = 0.0373$ for 110 parameters with 1902 reflections with $I > 2\sigma(I)$, $wR_2 = 0.0856$ for all data. The structure of type 1 contains two-dimensional ${}^2_2[(\text{UO}_2)_3(\text{SeO}_3)_2\text{O}_2]^{2-}$ sheets with the same topology as those found in guilleminite, $\text{Ba}[(\text{UO}_2)_3(\text{SeO}_3)_2\text{O}_2]\cdot 3\text{H}_2\text{O}$, and marthozite, $\text{Cu}[(\text{UO}_2)_3(\text{SeO}_3)_2\text{O}_2](\text{H}_2\text{O})_8$. Sr^{2+} cations and H_2O groups occur between the layers. In contrast, the structure of type 2 contains one-dimensional ${}^1_2[\text{UO}_2(\text{SeO}_3)_2]^{2-}$ ribbons with Sr^{2+} cations residing between them. This compound is isostructural with its Ca^{2+} -containing analog.