Hydrothermal synthesis and crystal chemistry of the new strontium uranyl selenites, Sr[(UO$_2$)$_3$(SeO$_3$)$_2$O$_2$]-4H$_2$O and Sr[UO$_2$(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$_2$ with SeO$_2$ in the presence of SrCl$_2$.6H$_2$O and Sr(OH)$_2$.8H$_2$O in super-critical water at 425 °C for 3 d results in the formation of the new strontium uranyl selenites, Sr[(UO$_2$)$_3$(SeO$_3$)$_2$O$_2$]-4H$_2$O (1) and Sr[UO$_2$(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 $P\overline{1}$, $a = 5.6722(4)$, $b = 6.7627(5)$, 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 $\frac{1}{6}[(UO_2)_3(SeO_3)_2O_2]^{2-}$ sheets with the same topology as those found in guilleminite, Ba[(UO$_2$)$_3$(SeO$_3$)$_2$O$_2$]-3H$_2$O, and marthozite, Cu[(UO$_2$)$_3$(SeO$_3$)$_2$O$_2$](H$_2$O)$_8$. Sr$^{2+}$ cations and H$_2$O groups occur between the layers. In contrast, the structure of type 2 contains one-dimensional $\infty[UO_2(SeO_3)_2]^{2-}$ ribbons with Sr$^{2+}$ cations residing between them. This compound is isostructural with its Ca$^{2+}$-containing analog.