

Low Dimensional Materials: Syntheses, Structures, and Optical Properties of $\text{Rb}_2\text{CuTaS}_4$, $\text{Rb}_2\text{CuTaSe}_4$, $\text{RbCu}_2\text{TaSe}_4$, $\text{K}_3\text{Ag}_3\text{Ta}_2\text{Se}_8$, and $\text{Rb}_3\text{AgTa}_2\text{Se}_{12}$

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Dedicated to Professor Kurt O. Klepp on the occasion of his 60th birthday

The new compounds $\text{Rb}_2\text{CuTaS}_4$ (**1**), $\text{Rb}_2\text{CuTaSe}_4$ (**2**), $\text{RbCu}_2\text{TaSe}_4$ (**3**), $\text{K}_3\text{Ag}_3\text{Ta}_2\text{Se}_8$ (**4**), and $\text{Rb}_3\text{AgTa}_2\text{Se}_{12}$ (**5**) have been synthesized by the reactive flux method at 773 or 873 K. Their crystal structures were determined by single crystal X-ray diffraction. Crystal data for **1**: space group $Fddd$, $a = 5.598(1)$, $b = 13.512(4)$, $c = 23.854(5)$ Å, $Z = 8$; Crystal data for **2**: space group $Fddd$, $a = 5.782(1)$, $b = 13.924(3)$, $c = 24.653(5)$ Å, $Z = 8$; Crystal data for **3**: space group $C2cm$, $a = 5.7218(3)$, $b = 19.2463(13)$, $c = 7.7456(5)$ Å, $Z = 4$; Crystal data for **4**: space group $C2/c$, $a = 25.1374(19)$, $b = 6.1007(3)$, $c = 14.4030(11)$ Å, $\beta = 119.703(8)^\circ$, $Z = 4$; Crystal data for **5**: space group $P2_1/n$, $a = 9.8186(6)$, $b = 13.7462(11)$, $c = 15.7368(9)$ Å, $\beta = 96.681(7)^\circ$, $Z = 4$. The compounds **1** and **2** are built up of ${}^\infty[\text{CuTaQ}_4]^{2-}$ anionic chains which are formed by edge-sharing CuQ_4 and TaQ_4 tetrahedra. The rubidium cations are located between the chains. Compound **3** consists of ${}^\infty[\text{Cu}_2\text{TaSe}_4]^-$ anionic layers separated by rubidium cations. The anionic layers are formed by ${}^\infty[\text{CuTaSe}_4]^{2-}$ chains which are connected by CuSe_4 tetrahedra that share common edges with the TaSe_4 tetrahedra of neighboring chains. In compound **4** ${}^\infty[\text{Ag}_3\text{Ta}_2\text{Se}_8]^{3-}$ anionic chains are found which are separated by potassium cations. These chains are formed by successive corner sharing of AgSe_4 tetrahedra and edge sharing between AgSe_4 and TaSe_4 tetrahedra. All three structures are closely related with the sulvanite (Cu_3VS_4) structure type. Compound **5** contains a one dimensional ${}^\infty[\text{AgTa}_2\text{Se}_{12}]^{3-}$ anionic chain formed by interconnection of AgSe_4 tetrahedra and $[\text{Ta}_2\text{Se}_{11}]$ units. In the structure three monoselenide, three diselenide, and one triselenide anions are found. Raman and far-IR spectroscopic data of compounds **1** and **4** were collected and an interpretation is presented.

Key words: Tantalum Compound, Quaternary Chalcogenides, Crystal Structures, Flux Reaction, Optical Properties