

Empressite, AgTe, from the Empress-Josephine mine, Colorado, U.S.A.: Composition, physical properties, and determination of the crystal structure

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ABSTRACT

The chemistry and composition of empressite, AgTe, a rare silver telluride mineral, has been mistaken in the mineralogical literature for the silver telluride stützite (Ag_{5-x}Te₃). Empressite from the type locality, the Empress-Josephine deposit (Colorado), occurs as euhedral prismatic grains up to 400 μm in length and contains no inclusions or intergrowths with other minerals. It is pale bronze in color and shows a grey-black to black streak. No cleavage is observed in empressite but it shows an uneven to subconchoidal fracture and Vickers hardness (VHN₂₅) of 142 kg/mm². Empressite is greyish white in color, with strong bireflectance and pleochroism. Reflectance percentages for R_{\min} and R_{\max} are 40.1, 45.8 (471.1 nm), 39.6, 44.1 (548.3 nm), 39.4, 43.2 (586.6 nm), and 38.9, 41.8 (652.3 nm), respectively.

Empressite is orthorhombic and belongs to space group *Pmnb* (*Pnma* as standard), with the following unit-cell parameters: $a = 8.882(1)$, $b = 20.100(5)$, $c = 4.614(1)$ Å, $V = 823.7(3)$ Å³, and $Z = 16$. Electron microprobe analyses gave the chemical formula Ag_{1.01}Te_{0.99}. The calculated density (from the ideal formula) is 7.59 g/cm³. The crystal structure has been solved and refined to $R = 4.45\%$. It consists of edge-sharing AgTe₄ tetrahedra forming sheets parallel to (010). The connectivity between the sheets is provided by Te-Te contacts (<2.9 Å) to complete the framework. The structural study presented here shows that empressite and stützite have different crystal structures.