

Solubility of selected critical metals in palladium telluride, an experimental study

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Among palladium tellurides there are four known minerals: kotulskite (PdTe), merenskyite (PdTe_2), telluropalladinite (Pd_9Te_4), and keithconnite (Pd_{3-x}Te). Kotulskite and merenskyite, belong the most abundant platinum-group minerals, among Pd and Te minerals. They are commonly found together with other platinum-group minerals and Cu-Ni-Fe sulphides in Cu-Ni-PGE mineral deposits, associated with mafic and ultramafic igneous rocks. Kotulskite rarely occurs as a purely PdTe phase. It commonly contains an admixture of other elements.

We have experimentally investigated the solubility of selected critical metals, in particular Bi, Cu and Sb in kotulskite and predicted stable associations in the corresponding ternary systems.

The evacuated silica-glass tube method was used for the purpose of this study. The experimental products were examined with X-ray powder diffraction, and in polished sections by means of reflected light and electron microscopy.

Kotulskite dissolves up to 40.3 at. % Bi, $\text{Pd}_{0.99}(\text{Te}_{0.21}\text{Bi}_{0.80})_{\sum 1.00}$ and at this maximum the solid solution breaks and there is a gap up to $\text{Pd}_{1.00}(\text{Bi}_{0.96}\text{Te}_{0.04})_{\sum 1.00}$ composition, forming PdBi dissolving 1.6 at. % Te, at 500 °C. Kotulskite dissolves up to 41.1 at. % Sb, $\text{Pd}(\text{Te}_{0.18}\text{Sb}_{0.82})_{\sum 1.00}$ at 400 °C. Kotulskite dissolves up to 5.6 at. % Cu at 400 °C. Kotulskite ss forms stable association with merenskyite (PdTe_2) and Cu-telluride ss. The Cu substitutes for Pd, Bi and Sb substitute for Te in the crystal structure of kotulskite.

The knowledge of solid solution series and maximum solubility of studied elements may help to better understand the mineral processing, in particular the extraction of certain elements from the ore-concentrates.