

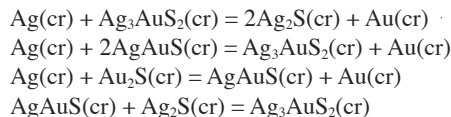
## **Determination of standard thermodynamic properties of sulfides in the Ag-Au-S system by means of a solid-state galvanic cell**

**EVGENIY G. OSADCHII\* AND OLGA A. RAPPO**

Institute of Experimental Mineralogy, Russian Academy of Sciences, Chernogolovka, Moscow District 142432, Russia

### **ABSTRACT**

Thermodynamic properties of the following phase reactions in the Ag-Au-S system have been investigated via electromotive force (EMF) measurements in solid-state galvanic cells with  $\text{Ag}_4\text{RbI}_5$  as a solid electrolyte:



The EMF temperature dependences observed for these reactions, together with auxiliary thermodynamic properties for  $\text{Ag}_2\text{S}$ , acanthite, from Robie and Hemingway (1995), result in the following standard thermodynamic properties at 298.15 K and 1 bar ( $10^5$  Pa):  $\Delta_f G^\circ(\text{Ag}_3\text{AuS}_2, \text{cr}) = -69478(200)$  J/mol and  $S^\circ(\text{Ag}_3\text{AuS}_2, \text{cr}) = 273.37(56)$  J/(mol·K) (uytenbogaardtite),  $\Delta_f G^\circ(\text{AgAuS}, \text{cr}) = -27621(210)$  J/mol and  $S^\circ(\text{AgAuS}, \text{cr}) = 128.11(60)$  J/(mol·K) (petrovskaitite), and  $\Delta_f G^\circ(\text{Au}_2\text{S}, \text{cr}) = 1077(650)$  J/mol and  $S^\circ(\text{Au}_2\text{S}, \text{cr}) = 128.1(2.0)$  J/(mol·K).  $\text{Au}_2\text{S}(\text{cr})$  is a thermodynamically metastable phase, but the values of its thermodynamic functions are open to discussion.