

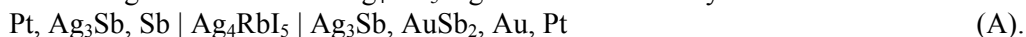
EXPERIMENTAL DETERMINATION OF STANDARD THERMODYNAMIC PROPERTIES OF AUROSTIBITE (AuSb₂)

Osadchii, E. (IEM RAS), Rappo, O. (Geol. department MSU), Lunin, S. (IEM RAS),

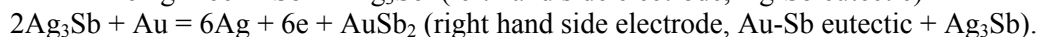
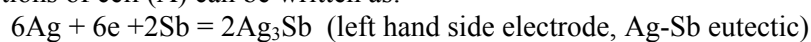
Zotov, A. (IGEM RAS)

euo@iem.ac.ru; fax: (252) 46-205; phone: (252) 46-205

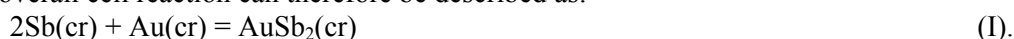
Thermodynamic properties of aurostibite (AuSb₂) were determined using electromotive force (EMF) method in galvanic cell with Ag₄RbI₅/Ag⁺ as a solid electrolyte:



Half cell reactions of cell (A) can be written as:



The overall cell reaction can therefore be described as:



It should be noted that the presence of discrasite (Ag₃Sb) in cell (A) is eliminated. The EMF values measured for cell (A) as a function of temperature are presented as linear equation $E = a + b \cdot T$, which implies $\Delta_r C_p = \text{constant}$, but not equal to zero, fitted to obtained experimental data yielded:

$$E(\text{A})/\text{mV} = (12.13 \pm 0.2) + (-0.018 \pm 0.003) \cdot T, \quad (230 < T/\text{K} < 430, R^2 = 0.95).$$

The Gibbs free energy and entropy change of the reaction (I) can be calculated from EMF of galvanic cell (A) using the following equations:

$$\begin{aligned} \Delta_r G (\text{J} \cdot \text{mol}^{-1}) &= -n \cdot 10^{-3} \cdot F \cdot E \\ \Delta_r S (\text{J} \cdot \text{K}^{-1} \cdot \text{mol}^{-1}) &= n \cdot 10^{-3} \cdot F \cdot (dE/dT) \\ \Delta_r H (\text{J} \cdot \text{mol}^{-1}) &= -n \cdot 10^{-3} \cdot F \cdot [E - (dE/dT) \cdot T], \end{aligned}$$

where n is the number of electrons participating in the cell reaction, F stands for the Faraday constant $96484.56 \text{ C} \cdot \text{mol}^{-1}$, and E is the cell EMF in millivolts. The standard Gibbs energy and standard entropy at 298.15 K and 1 bar pressure of AuSb₂(cr) were calculated as follows:

$$\begin{aligned} \Delta_r G^\circ(\text{AuSb}_2, \text{cr}) &= -\Delta_r G^\circ(\text{I}) \\ S^\circ(\text{AuSb}_2, \text{cr}) &= 2S^\circ(\text{Sb, cr}) + S^\circ(\text{Au, cr}) + \Delta_r S^\circ(\text{I}). \\ \Delta_r G^\circ(\text{AuSb}_2, \text{cr}, 298.15 \text{ K}) &= (-4000 \pm 300) \text{ J} \cdot \text{mol}^{-1} \\ \Delta_r S(\text{I}) &= (-10.48 \pm 0.5) \text{ J} \cdot \text{K}^{-1} \cdot \text{mol}^{-1} \\ \Delta_r H^\circ(\text{AuSb}_2, \text{cr}, 298.15 \text{ K}) &= (-7100 \pm 400) \text{ J} \cdot \text{mol}^{-1} \\ S^\circ(\text{AuSb}_2, \text{cr}) &= (128 \pm 7) \text{ J} \cdot \text{K}^{-1} \cdot \text{mol}^{-1}. \end{aligned}$$

Due to very sluggish reaction the data above should be considered as previous. Presumably phase transition pyrite - marcasite takes place in aurostibite in temperature interval (435-450 K).

Financial support by RFBR. Grant No 03-05-64380.

*Electronic Scientific Information Journal "Herald of the Department of Earth Sciences RAS" № 1(21) 2003
Informational Bulletin of the Annual Seminar of Experimental Mineralogy, Petrology and Geochemistry – 2003
URL: http://www.scgis.ru/russian/cp1251/h_dgggms/1-2003/informbul-1_2003/mineral-10e.pdf
Published on July 15, 2003*

© Department of the Earth Sciences RAS, 1997-2003
All rights reserved