THERMOGRAVIMETRIC MEASUREMENT OF THE VAPOR PRESSURE OF SILICON MONOXIDE FROM 1300K TO 1773K USING AN ALUMINA EFFUSION CELL

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Introduction: In this paper we will report new measurements of the vapor pressure of Silicon Monoxide (SiO), over the temperature range from 1573K to 1773K, obtained thermogravimetrically, in vacuo using alumina effusion cells. We have previously reported the vapor pressures of iron [1,2], nickel [3] and cobalt [4] metals also measured in vacuo using alumina effusion cells and the same commercially-obtained Thermo-Cahn TG-2171 Thermogravimetric system. In these previous studies we found that our nickel data agreed with current estimates of it's vapor pressure in the literature [5], while our measurements of cobalt were ~ 50% lower than the literature value [6] and our measurements of iron vapor pressure were a factor of two lower than previously predicted [7]. The major advantage of our technique over previous studies is that it directly tracks the mass lost from the effusion cell where the vapor of interest is maintained in thermodynamic equilibrium with its solid or liquid reservoir. This eliminates considerable confusion encountered in more open systems which must simultaneously measure both the vapor pressure of the material and the accommodation coefficient of the vapor as it condenses on the solid or liquid reservoir. The convolution of these factors can lead to wide variation in the estimates of the vapor pressure even for direct experimental measurements. The best estimate of the vapor pressure of SiO as a function of both temperature and oxygen fugacity was published by Schick [8], yet that vapor pressure curve is 5 orders of magnitude higher than recent measurements by Shornikov et al. [9].

New Measurements: Our measurements of the vapor pressure of SiO lie between those of Schick[8] and Shornikov et al. [9], though they are closer to the predictions of Schick [8]. At ~1300K our measurements show that the SiO vapor pressure is two orders of magnitude lower than predicted by Schick [8], but that this gap shrinks to less than an order of magnitude difference at 1773K. It appears that our measurements may intercept Schick's SiO vapor pressure curve below 2000K. We will make more measurements and push our experiment to higher temperatures (possibly as high as 1973K) and discuss the full range achieved at the meeting.

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