

Ag diffusion in Fe-Ni alloy

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Introduction

The short-lived ^{107}Pd - ^{107}Ag system (~ 6.5 My) is a versatile dating tool during the first few million years of the solar system [1, 2]. The closure temperature quoted for the Pd/Ag system is assumed to be at ~ 1100 K [2]. However, the closure temperature of Ag in Fe-Ni alloy has not been constrained experimentally.

We conducted a series of experiments to measure Ag diffusion in Fe-Ni alloy ($\text{Fe}_{90}\text{Ni}_{10}$) of 90 wt.% Fe and 10 wt.% Ni using piston cylinder apparatus at 1100 - 1400 °C at 1 GPa at Rensselaer Polytechnic Institute (RPI) and Union College. The diffusion properties of Ag in $\text{Fe}_{90}\text{Ni}_{10}$ were measured using the Cameca SX-100 electron microprobe under 15 kV and 200 nA at RPI. Three analytical line profiles (~ 10 μm increments) are close to the center of each sample.

Results

Figure 1 is an Arrhenius plot of Ag in $\text{Fe}_{90}\text{Ni}_{10}$, including results of siderophile (Ni, Mo, Pd, Au), chalcophile (Cu), and lithophile (P) elements from previous studies [3]. Our preliminary results show that the activation energy for Ag in Fe-Ni alloy is approximately 257 ± 25 kJ/mol, compared to 270 kJ/mol for Cu and to 347 kJ/mol for Pd. The calculated D_0 is 4×10^{-5} m^2/s . These data will be used to calculate closure temperatures of Ag in iron meteorites.

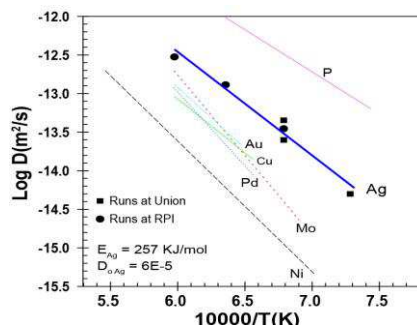


Figure 1: Arrhenius plot of Ag in $\text{Fe}_{90}\text{Ni}_{10}$ adapted from Watson and Watson [3].

- [1] M. Matthes et al. (2018) *Geochim Cosmochim Acta* 220, 82-95. [2] Sugiura and Hoshino (2003) *MAPS* 38, 117-143.
[3] Watson and Watson (2003) *Phys. Earth Planet. Inter.* 139, 65-75.