

Probing the Compositional Effects on Fe-isotope Fractionation Between Solid and Liquid Metal Alloys

NEIL R BENNETT, JESSICA D VERSCHOOR AND
CORLISS KIN I SIO

University of Toronto

Presenting Author: neil.bennett@utoronto.ca

There is a wealth of literature reporting trace element partitioning between Fe-rich solid and liquid metal alloys. These studies probe the effect of light elements (e.g., S, P, Si, C) on partitioning, and document pronounced dependencies of solid metal-liquid metal partition coefficients ($D^{sol/liq}$) on the composition of the liquid alloy phase. These data are often interpreted within the context of the “Fe Domain” model, in which the liquid is described as a mixture of Fe and Fe-plus-light-element domains [1]. Implicit in this model, is that the bonding environment for iron in these different domains is distinct. This suggests the potential for a similar compositional dependence for Fe-isotope fractionation between solid and liquid metal. This expectation was not born out by a recent study in the Fe-S system, which reported no systematic change in Fe-isotope fractionation as a function of the sulfur content of liquid metal [2]. Some studies of metal-silicate Fe-isotope fractionation, however, have observed a dependence on liquid metal composition [3,4], and sulfur appears to enhance Fe-isotope fractionation in thermal diffusion experiments on Fe-rich alloys [5]. These contrasting results provide a motivation to further probe the light-element effect on Fe-isotope partitioning. To this end, we have begun solid metal-liquid metal equilibration experiments in the Fe-P system. We will present preliminary results on Fe-isotope fractionation in this system with a view towards the crystallization of asteroidal cores.

[1] Chabot & Jones (2003), *MAPS* 38, 1425-1436.

[2] Ni, Chabot, Ryan & Shahr (2020), *Nature Geoscience* 13, 611-615.

[3] Shahr, Hillgren, Horan, Mea-Garcia, Kaufman & Mock (2014), *Geochimica et Cosmochimica Acta* 150, 253-264.

[4] Elardo & Shahr (2017), *Nature Geoscience* 10, 317-321.

[5] Leshner, Dannberg, Barfod, Bennett, Glessner, Lacks & Brennan (2020), *Nature Geoscience* 13, 382-386.