Partitioning of potassium between Fe-sulfide and silicate at high pressure and high temperature

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It has been suggested that there are heat sources in the earth's core. One of the candidates is potassium. Partitioning of potassium between metallic liquid and silicate melt under high temperature and high-pressure are important to clarify the amount of potassium in the earth's core. In the previous works, experiments were performed below 26 GPa using a large volume press (e.g. Ito et al., 1993; Gessmann et al., 2002; Murthy et al., 2003), except for the work by Hirao et al. (2005).

We performed the partitioning experiments at higher pressure conditions using a laser-heated diamond anvil cell up to 110 GPa and 2900 K. The starting material of metal was a mixture of Fe (99.5% pure) and FeS (99.9% pure) with the bulk composition of Fe86.8S13.2 in wt%. Natural Adularia ($K_{0.973}Na_{0.020}Al_{0.998}Fe_{0.0006}Si_{3.003}O_8$) was used as the silicate material. To identify the reaction phases, we used the powder X ray diffraction method and EPMA. Murthy et al. (2003) reported that polishing of samples using oil lubricants results in substantial K loss from Fe-S phase with in a few hours. So, in this study, preparation of the recovered samples for the EPMA analysis was made by the dry polished method.

In this study, we observed an increase in solubility of potassium into metal with increasing temperature. This trend is consistent with the previous works. Furthermore, the negative pressure dependence on solubility of potassium into metal was observed in this work.