Partitioning of Ni and Co between metallic iron and lower mantle minerals at high pressures

Naoki Sawada[1]; Eiji Ohtani[2]; Tadashi Kondo[3]; Hidenori Terasaki[4]; Masaaki Miyahara[1]

[1] Inst.Mineral. Petrol.& Econ. Geol., Faculty of Sci.,Tohoku Univ; [2] Inst. Mineral, Petrol. & Econ. Geol.,Tohoku Univ; [3] Osaka Univ.; [4] Inst. Mineral. Petrol. and Econ. Geol., Tohoku Univ.

The abundance of siderophile elements in the mantle and a partitioning behavior of siderophile elements between metallic iron and silicate minerals play important role to estimate the condition of chemical reaction between core and mantle materials.

Previous studies of Ni, Co partitioning based on multi anvil experiments show that partition coefficients of Ni, Co decrease with increasing pressure and increasing oxygen fugacity. There are only a few previous works using diamond anvil cell (DAC) because of its technical difficulty. Bouhifd & Jephcoat (2003) performed partitioning experiments between metallic iron and silicate melt with DAC up to 42 GPa and 2500 K. their results also indicate that the partition coefficients decrease with increasing pressure.

To clarify the partitioning behavior at higher pressure condition, In this study, partitioning experiments of Ni and Co between metallic iron and lower mantle minerals (magnesium silicate perovskite and magnesiowustite) were performed at 50-75 GPa, 2660-2840 K with a laser-heated diamond-anvil cell (LHDAC). Starting materials were Fe foil sandwiched by an Olivine powder or an enstatite powder. Sample was heated using Nd: YAG laser on both sides. Textural observation and chemical analysis of the recovered samples were performed using EPMA and FE SEM/EDS. The exchange partition coefficients of Ni and Co between metallic iron and Mg-perovskite were 6.7-6.8 and 4.1-7.7, respectively and the difference between these values became to be small (DNi/DCo ˜0.9 at 75 GPa, 2840 K). In the experiments between metallic iron and magnesiowustite, the partition coefficients tend to decrease slightly with increasing pressure and oxygen fugacity. The exchange partition coefficients of Ni and Co decreased with increasing pressure. These results showed that Ni and Co become to behave similar at high pressure.