Behavior of nitrogen contained aromatic compound under high-pressure and high-temperature conditions under deep interior of the Earth.

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Aromatic compounds are known to the most abundant organic materials in nature and sediments in the Earth’ s surface and also in interstellar clouds and carbonaceous meteorites. Furthermore, aromatic compounds are found in inclusions from mantle xenoliths (Garanin et al., 2011; Tomilenko et al., 2016). Behavior of aromatic hydrocarbon molecules in the interior of the Earth has been investigated in experimental approaches. Temperature-induced oligomerization of polycyclic aromatic hydrocarbons was found at around 800 K at high pressure conditions (Chanyshev et al., 2015, Chanyshev et al., 2017). In this study, chemical reactivity and reaction pathway of a nitrogen-containing heteroaromatic compound under high-pressure and high-temperature were investigated experimentally.

For the high-pressure and temperature experiments, phthalazine ($C_8H_6N_2$) was applied as a starting material. A piston-cylinder type high pressure apparatus was used for the experiments at 0.5-1.5 GPa and 374-573 K. After the experiments, the samples were recovered to ambient condition and then, analyzed using elemental analyzer, GC-FID, GC-MS, and MALDI-TOF/MS.

Decreasing of remained phthalazine and formation of various reaction products were observed >523 K at 0.5 GPa and >548 K at 1.5 GPa, indicating a chemical reaction of phthalazine. Significant decreasing of N/C ratio in the solid reaction products was observed with the chemical reaction, indicating selective distribution of nitrogen into volatile phase. MALDI-TOF/MS analysis showed that the various reaction products have heavier mass number than the phthalazine up to m/z=780, indicating that the reaction mechanism includes oligomerization of phthalazine. Precise analyses for molar weights and possible molecular structure of the reaction products were performed using GC-FID and GC-MS to reveal the reaction pathway of phthalazine and the effect of pressure. In the presentation, the behavior of nitrogen contained in aromatic compounds under deep interior of the Earth will be discussed from the experimental result.

Keywords: Subduction, Nitrogen , High-pressure and high-temperature experiments

