

Development for hydrogen diffusion experiments under Ar/D₂ and D₂O condition

*Shoichi Itoh¹, Yoshinori Higashi¹, Ryo Aoki¹, Isao Sakaguchi²

1. Graduate school of Science, Kyoto University, 2. NIMS

There are many uncertainties about the origin of hydrogen in the earth. Especially, hydrogen isotopic compositions of the early earth are unclear. The characteristics of water of mantle in the early earth would be able to expect to estimate from those of hydrous minerals, for example, apatite crystals in the hadean and archean. However, without an understanding of hydrogen diffusivity in these hydrous minerals, it is difficult to estimate whether original hydrogen isotopic compositions from crystallization are preserved or the subsequently modified by reactions with water or H₂ gas after crystallization. Therefore, this study reports development of the diffusion experiment for hydrous minerals with diffusion source of water and Ar/D₂ gas.

The diffusion annealing system in this study could chose between D₂O line and Ar/D₂ line for the diffusion source. In addition, this system chose flow type and close type with vacuum system for the control of partial pressure in the crystal surface. Therefore, we need to estimate the residue of H₂O and D₂O absorbed in the line and quartz tube when the Ar/D₂ gas line are selected.

The quantitative analyses for residue of absorbed water were estimated by annealing of apatite crystals in the different condition with the depth profile by Kyoto 4f-e7 secondary ion mass spectrometry (SIMS). This talk will discuss the results of different diffusion source in the apatite crystals and methods of control the partial pressure of Ar/D₂ diffusion experiments.

Keywords: Hydrogen, diffusion, SIMS