Hydrothermal alteration experiments of amorphous silicates

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Carbonaceous chondrites are the most primitive meteorites and record the information of the early solar system. Among them, CI, CM, CR and TL chondrites experienced strong aqueous alterations on their parent bodies. Therefore, a study of the alteration process is important for understanding the evolution of early solar system materials. In order to investigate the aqueous alteration process, many hydrothermal experiments have been performed using crystalline silicates, such as olivine and enstatite, or chondrites themselves. On the other hand, slicate in molecular cloud dust is considered to be amorphous based on IR astronomical observations. In addition, Acfer094, the unique charbonaceous chondrite, contains many primitive amorphous silicates in the matrix. Therefore, it is important to investigate the aquous alteration of the amorphous silicates.

In order to understand the aqueous alteration process and its condition on the chondrite parent bodies as the final goal, we have carried out hydrothermal alteration experiments of synthetic amorphous silicates with the CI chondritic composition. The starting amorphous silicates were synthesized by the sol-gel method. A mixture of the starting material and deionized water (or acid/alkali solutions) was put in an inner reaction vessel of Teflon with an outer stainless steel jacket (SUS-316). The vessel was heated in an electric furnace at 150^{o}C for 1 week. Run products of the hydrothermal experiments were analyzed using X-ray diffraction and scanning electron microscopy equipped with energy-dispersive X-ray spectroscopy. It was found that smectite was easily formed even in deionized water. We will report the experimental results for the amorphous silicates in comparison with those for crystalline ones as well as the mineral assemblages of chondrites.