

In-situ experiments of aqueous alteration of amorphous silicates in the system MgO-SiO₂.

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Amorphous silicates, particularly their nanoparticles, are highly reactive with water. However, it is not clear how they change with water in early stage, in particular, right after the contact with water. In this study, we conducted in-situ experiments of aqueous alteration of amorphous silicate in the system of MgO-SiO₂. The starting materials are nanoparticles typically 70 nm in diameter with two different compositions (MgO/SiO₂ = 2.02 and 1.15), which were synthesized by an induction thermal (ITP) plasma system. We performed two different types of experiments using transmission electron microscopy (TEM) and X-ray diffraction (XRD) in ultra-pure water in a closed cell at room temperature.

The starting materials started to change quickly (sufficiently shorter than 1 hr.) after mixed with water in both samples. The in-situ TEM experiment showed that particles gradually expand in water. Peak shift of amorphous halo in the in-situ XRD patterns implies hydration of amorphous silicate and dissolution of Mg²⁺ from amorphous silicate into water as well. Phyllosilicate-like poorly-crystalline materials named magnesium silicate hydrates (M-S-H) [1] was formed by dissolution-precipitation process; it was precipitated from supersaturated solution formed by the rapid Mg²⁺ dissolution. The structure and texture of M-S-H were changed after drying, indicating that there are aqueous-alteration products of two different generations, during reaction in water and drying. This is important for interpretation of run products of aqueous alteration after drying.

Primitive carbonaceous chondrites have amorphous silicates as building blocks of the solar system (e.g., [2]). We applied the results to initial aqueous alteration process of such amorphous silicates.

[1] Roosz et al., 2015, *Cement Concrete Res.* **73**, 228-237. [2] Leroux et al., 2015, *Geochim. Cosmochim. Acta* **170**, 247-265.