Condensation Experiments of Mg-Si-Fe-Ni-Al-Ca-O-S Silicates in ITP System

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Glass with embedded metals and sulfides (GEMS) is the major component of CP-IDPs which is one of the most primitive materials in the solar system [e.g. 1, 2]. GEMS has characteristic textures such as Fe-Ni metal subgrains inside and Fe-Ni sulfides on the surface of amorphous silicates.

Condensation experiments of gases were performed using induction thermal plasma (ITP) systems to examine the dependence of textures and chemical compositions of condensates on condensation conditions and chemical compositions of gases [3-6]. Mineralogy and texture largely depend on redox conditions of gases [4,6]. The experiments in [3, 5] were performed in the systems of Mg-Si-Fe-Ni-Al-Ca-O but did not include sulfur in the starting materials.

In this study, we performed condensation experiments of gases in the systems of Mg-Si-Fe-Ni-Al-Ca-O-S. We used powders of SiO_2 (quartz), Si, MgO (periclase), Fe, Ni, FeS_2 (pyrite), Al_2O_3 (γ-alumina), CaO, and Na_2SiO_3 as starting materials. Redox conditions were controlled by changing Si/SiO_2 ratio in the starting materials. Either CI chondrite (CI experiments) or GEMS mean composition (GEMS experiments) [1] was adopted as the chemical composition of the starting materials. The condensates were analyzed by XRD, FT-IR, SEM and TEM to determine the chemical composition and mineral phases of the condensates. All condensates contain amorphous silicates and metallic Fe-Ni metal subgrains. Amorphous silicate rich in Fe and some Fe-Ni metals/sulfides were condensed in both of the CI and GEMS experiments under oxidative conditions. Under very reduced conditions, in addition to Fe-poor amorphous silicate, iron silicide and sulfide grains were condensed in the GEMS and CI experiments, respectively.

[1] Keller and Messenger (2011) *GCA*, 75, 5336. [2] Ishii et al. (2018) *PNAS*, 115, 6608. [3] Matsuno et al. (2014) *LPS XXXXV*, #1335. [4] Matsuno (2015) ph.D thesis. [5] Kim et al. (2017) *IPSC*, #780. [6] Kawano et al. (2018) JpGU, PPS09-09.