

Direct Observation of Crystallization of Carbon Coated Amorphous Mg-Bearing Silicate Grains

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In a previous paper, we demonstrated that the crystallization of amorphous Mg-bearing silicate grains to the Mg_2SiO_4 crystal took place at 800C in vacuum. The crystallization started from the grain surface. The phenomenon of the pre-nucleation states corresponded to the stall state suggested and clarified by IR spectroscopy by Hallenback and Nuth have been directly observed at the temperature range of 650 to 800C. On the crystallization of cometary silicates, Yamamoto et al have proposed a chemical heating model as a mechanism of crystallization of cometary silicate, and have shown that the chemical heating mechanism loads to the crystallization degree needed to explain the observed strength of the cometary crystalline features. In order to laboratory analogies on this model, the amorphous Mg-bearing silicate grains which crystallized at 800C were covered with amorphous carbon layer. Since the amorphous carbon layer on the surface of CdTe nanoparticle was crystallized to the graphite layer by heating at 500C, influence of graphite structure alteration on the surface to the central Mg-bearing silicate grains have been examined by in-situ experiment in the transmission electron microscope. It was found that pre-nucleation did not observe but the crystallization took place at 600C which is lower in previous report. Therefore, the chemical energy due to the graphitization lowered the crystallization temperature.