

## Kinetic condensation of metallic iron at low supersaturation

# Yohei Ikeda[1]; Hiroko Nagahara[2]; Shogo Tachibana[3]

[1] Earth and Planet Sci., Univ. of Tokyo; [2] Dept. Earth Planet. Sci., Univ. Tokyo; [3] Earth and Planet. Sci., Univ. of Tokyo

Solid particles are formed by condensation of gaseous species in a low-pressure environment such as in protoplanetary disks and around evolved stars, where condensation should not necessarily occur under equilibrium conditions. Thus kinetics of condensation should be examined in detail in order to understand evolution of solid materials in space. In this study, we focus on kinetic condensation behavior of metallic iron, one of major solid materials in space, at low supersaturation, and examine the condensation kinetics as a function of temperature and supersaturation.

Condensation experiments of metallic iron were carried out in a vacuum chamber with a tungsten-mesh furnace. A metallic iron pellet put at the end of an alumina tube (6 mm in diameter) was heated at about 1300 C, and evaporated iron gas, coming out from the alumina tube, was condensed on a molybdenum substrate placed at a hole in a reflector. The substrate was 6cm apart from the hotspot of the furnace and its temperature was controlled at  $961 \pm 2.5$  C. Note that the advantage of this method is that the gas flux incoming to the substrate can be controlled independently from the condensation temperature.

Condensates were observed with FE-SEM, and their chemical compositions were analyzed with EDS for chemical composition. All the condensates were metallic iron except for a small amount of contaminants from the alumina tube and the heater.

The supersaturation ratio ( $S$ ) for the present experimental condition was calculated to be 5-8 based on the pressure of incoming iron gas, determined by the mass loss of the metallic iron pellet through the alumina tube, and the equilibrium vapor pressure of metallic iron at 961 C. The actual condensation flux, determined by the weight gain of the substrate, was compared with the ideal condensation flux, and was found to be almost the same as or 0.9 times smaller than the ideal flux.. This implies that kinetic condensation of metallic iron occurs almost at the ideal rate at low super saturation.