Surface Microtopography of Matrix Olivine Particles

Junya Yamada[1]; Katsuo Tsukamoto[2]; Hidekazu Kobatake[3]; Jun Nozawa[4]

[1] Graduate School of Science,Tohoku Univ.; [2] Graduate School of Science, Tohoku University; [3] IMRAM.; [4] Geology, Sci., Tohoku Univ

1. Introduction

Vaporization and condensation are the most important processes in the early solar nebula. Olivine fine particle composing meteorites are inferred to have condensed from cooling vapor in the early solar nebula. To clarify the environment of the early solar nebula, many condensation experiments have been carried out by various methods.

2. Methods of investigation

To elucidate the growth condition of cosmic forsterite from vapor, the growth surface form of such particle was investigated experimentally as a function of the growth temperature supersaturation by flash-heating method using CO^2 laser irradiation. Surface micro topography of the forsterite crystal was observed by Atomic Force Microscopy (AFM) and Differential Interference Contrast Microscopy (DICM). The growth cell with thermo-couple was made of graphite. It was set in the vacuum chamber. Experiment was carried out at Ar 100 Pa. The sphere forsterite were heated by CO^2 laser radiation and vaporized. The vapor deposition occurred on the forsterite substrate.

3. Results and discussion

A few um sized 2-dimentional nucleation growth islands were observed on the surface. The step height was 0.3 nm-few nm. Various surface patterns were observed , the rectangular islands with smooth-edge step(T=1500-1800K,s=less than 2), the island with rough-edge step(T=1200-1500K,s=3-10) and droplet type (T=less than 1100K,s=more than 16). It was confirmed that the growth surface of the forsterite crystal was systematically changed depending on the temperature (T) and the supersaturation of the vapor (s). The experimentally synthesized coexisting patterns of VS-grown and VLS-grown olivine crystal surfaces resemble the pattern of matrix olivine crystal surfaces in primitive meteorite.