KINETIC CONDENSATION OF MAGNESIAN SILICATES IN REDUCING AND OXIDIZING CONDITIONS. S. Tachibana[1], H. Nagahara[1] and K. Ozawa[1]. [1]Department of Earth and Planetary Science, University of Tokyo, 7-3-1 Hongo, Tokyo 113-0033, Japan. E-mail: tachi@eps.s.u-tokyo.ac.jp

Introduction: Magnesian silicates are dominant constituents of dust particles in the solar system and protoplanetary disks, and around evolved stars. The sizes, shapes, compositions, and crystallinities of magnesian silicates should depend on their formation conditions and histories, and it is therefore important to understand formation processes of magnesian dust particles under plausible circumstellar conditions. Understanding of kinetics of dust formation processes is essential because dust formation in circumstellar environments is likely to occur under non-equilibrium conditions.

Experiments: In order to simulate formation of magnesian silicate dust in space, we have carried out condensation experiments in the Mg-Si-O system using infrared vacuum furnace [e.g., 1], where a gas source of forsterite has been heated in a graphite crucible. However, the graphite capsule used as a light absorber may make a reducing condition in the furnace, and may be the cause of formation of molybdenum silicide on the Mo substrate.

In this study, we carried out condensation experiments of magnesian silicates under the same experimental conditions to the previous study [1] except for using forsterite put in an iridium crucible as a gas source. The heating temperature of the gas-source forsterite was ~1850 K, and the condensation temperatures ranged from 1420 to 800 K depending on the interval between the gas source and the Mo substrate. The typical experimental duration was ~20 hours.

Results and Discussion: No condensates were found at 1400, 1330 and 1260 K. Magnesium silicates of 10-100 nm in diameter condensed at 1190 K. They formed at lower temperatures as well (1060, 1000, 940, and 800 K). Condensates were too small for EBSD analyses; crystallinities of condensates have not yet been determined.

In the present experiments using the iridium crucible, no molybdenum silicide was found and magnesium silicates formed 1190 K, while molybdenum silicide formed at a similar temperature (1130 K) in the previous experiments using a graphite capsule. Such a difference of condensates clearly shows that the graphite capsule worked as a reducing agent in the previous experiments, and that evaporation of silicon as monatomic Si may have resulted in formation of Mo silicide as condensates.

Condensates formed in the present study are different from those formed in previous condensation experiments [2, 3], where crystalline forsterite easily formed at higher temperatures. Differences in fluxes of condensing gas species and their motion in the furnace may cause the difference in crystallinity of condensates, i.e., smaller incoming fluxes of Mg, SiO, and O onto the substrate and rare encounter of adsorbed atoms (molecules) may prevent nucleation of magnesian silicates at high temperatures with low supersaturation in the present experiments.

References: [1] Tachibana et al. (2008) *Meteoritics Planet. Sci.* 43, A5270. [2] Nagahara H. et al. (1988) *Nature* 331, 516. [3] Tsuchiyama, A. (1998) *Mineral J.* 20, 50-89.