

Heating experiment for chondrule formation with 4D observation.

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Formation process of chondrules, rocky spherules less than 1mm in diameter found in meteorites, is one of the key issues for the study of evolution of solid materials in early solar nebula. Because chondrules dominate more than 80% of volumes of chondrites, the formation process would directly affect the formation process of terrestrial planets and asteroids.

In previous studies, a number of heating experiments for the reproduction of their characteristic textures were conducted [e.g. 1-4]. However, complete reproduction of all their textures has not been succeeded yet. One of the problems is difficulty to determine the relation between the structure of initial material and final products after the heating, because growth process of crystals inside the chondrules is difficult to observe during the cooling. Silicate materials melted around 2000K emit strong radiation. In this situation, phenomenon inside a few mm sample is difficult to observe with high spatial resolution by visible light.

In this study, we developed a new instrument for in situ 4D observation, 4D means 3D + time elapse, of crystallization process of chondrules using synchrotron radiation, and conducted heating experiments of analog materials of chondrules. The sample was heated by infrared image furnace above its melting temperature, from 1400 K to 2000 K and cooled with a certain rate with the temperature controller under the atmosphere controlled environment. Cooling and CT measurement have been done at the same time by continuous rotating of sample, therefore, time series of volumetric data of the sample during the crystallization process were acquired.

We show preliminary result of the experiments, and discuss the comparison with the result of heating experiments of previous studies.

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