

4D in situ observation of formation process of chondrules

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Chondrule is tiny rocky spherules around 1mm in diameter, and constitutes a large volume of chondrite which dominates more than 80% of meteorites fallen onto the Earth. Dating studies using radiogenic nuclides have showed that they were formed in very early stage of the solar nebula evolution, and thus would show the important step of the evolution of solid materials which formed rocky planets, i.e. terrestrial planets and asteroids.

Their shape clearly indicates that they were solidified from molten droplets. However, the formation process of them, such as heat source and thermal history, precursor material, formation region in the early solar nebula, are still unknown.

In previous studies, several heating experiments for the reproduction of their characteristic textures were conducted. However, complete reproduction of their textures has not been succeeded yet. One of the difficulties is that growth process of crystals inside the chondrules is difficult to observe. Silicate materials melted above 2000K emits strong radiation. In this situation, phenomenon occurred inside a few mm sample is difficult to observe with high spatial resolution by visible light.

In this study, we developed a new devise for in situ 4D observation, 4D means 3D + time elapse, of crystallization process of chondrules using synchrotron radiation computed tomography, and conducted heating experiments of analog materials. We show preliminary result of the experiments, and discuss the problems of heating experiments of previous studies based on the results obtained by our new setup. We will also show future plan for our investigation, and also show the possible heating experiment for the chondrule formation using the system.

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