

In Situ observation of the Segregation Process of Molten Iron from Partially Molten Silicate using X-ray Radiography

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We have made in situ observation of the segregation process of molten iron from partially molten silicate at 5 GPa and 1800 K using X-ray radiography. Earth's core is believed to have formed by the similar process in the early stage of Earth formation. Although two measure mechanisms, "rain fall" and "percolation", have been proposed for this process, experimental results are still quite controversial. Most of the previous works were made either by the texture analysis of the quenched and recovered sample or by the electrical conductivity measurement. In the present study, an uniform mixture of the powders of Mg(OH)₂, SiO₂, and Fe was compressed to 5 GPa at room temperature and then X-ray tomography observation was made with increasing temperature up to 1800 K. Addition of H₂O component into silicate-iron system reduces the melting temperature of both silicate and iron considerably. The dynamical process of the formation of iron ball at the bottom of the sample chamber was clearly observed. It was proved that this technique is quite useful to study such process in detail.

Keywords: core formation process, molten iron, x-ray, high pressure and temperature