

Hugoniot measurement of calcite under meteorite collision condition

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Volatile substances inside planetary materials are generated and released as gas under the extreme condition caused by collision phenomenon that is thought to contribute greatly to the formation of the planetary atmosphere [1]. Particularly the degassing reaction of carbonate, may generate CO or CO₂ as greenhouse gas and affect the temperature of the planetary surface. A typical planetary mineral as carbonate of calcite (CaCO₃) is expected degassing above 3300 K at pressure of 150 GPa along the Hugoniot [2].

In the previous study, the experimental investigations for the shock-degassing reaction were carried out only below the impact pressure of 100 GPa. Also, we have not understood when the degassing reaction of calcite occur on a compressed state or a released state [3]

In natural, typical meteorite impacts exceed 10 km/s in impact velocity, and can generate at the pressure above 150 GPa. The purpose of this research is to understand the impact compression characteristics of calcite under the meteorite collision condition.

This experiment was conducted in Shock Drive Laser (Gekko XII) at Institute for Laser Engineering, Osaka University. The target consists of polypropylene as an ablator aluminum as a piston, quartz as a standard material, and calcite as a sample from laser side. The impact pressures and temperatures were estimated by the measured shock wave velocity using Velocity interferometer system for any reflector (VISAR) and self-emission intensity using radiance thermometer (SOP).

As a result of this experiments, we obtained the Hugoniot data at the pressure from 200 GPa to 1 Tpa at the temperature above 5000 K. The detailed results will be shown as this presentation.

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