P136-028 **Room: 304** **Time: May 22 15:03-15:15**

Experimental study on shock wave propagation in core-mantle bodies

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Introduction:

In order to clarify the physical processes of collisional disruption of parent bodies, it is important for us to understand the characteristics of the shock wave propagation in them. Previous studies were conducted for numerical and experimental studies of shock wave attenuation in water ice and rocks [Ahrens and O'Keefe, 1977; Pierazzo et al., 1997; Kato et al., 2001]. Both homogenous bodies and differentiated (core-mantle) bodies could exist in the proto-planetary nebula. We consider that the shock wave propagation in core-mantle bodies are quite complicated in comparison with that in homogenous bodies. Therefore, we should investigate the shock pressure variation in the core-mantle body, especially at the boundary of layers. So, we measured the shock pressure history in a two-layer plate sample by using embedded gauges.

Experimental:

We performed laboratory impact experiments by using two-stage light gas gun set up in Nagoya University. A projectile made of nylon with their length and diameter of 2.6mm and 1.6mm, respectively was used. Impact velocity ranged within 2.3-2.7km/s. In order to measure the shock pressure at the boundary in the two-layer plate sample, we prepared a plate sample with a gypsum plate (porosity ~50%) which thickness is 4mm and a glass plate which thickness is 5mm and a plate sample with a gypsum plate (porosity ~50%) which thickness is 5mm and a glass plate which thickness is 5mm. The gauge was sandwiched between the gypsum plate and the glass pate. Moreover, we measured the shock pressure attenuation in the glass region of the two-layer sample. The gauge was sandwiched between the glass plates. The pressure-time profile was measured by a piezoresistive carbon gauge (model C-300-50-EKRTE, manufactured by Dynasen Inc.) and a pulse power supply (model CK-1-50-300, manufactured by Dynasen Inc.).

Results and Discussion:

The shock pressure at the boundary between the gypsum plate and the glass plate showed the maximum value after about 0.001 ms from the arrival of the shock wave. The average velocity of the shock wave was between 1.73km/s and 2.07km/s. These values are similar to the bulk sound velocity of gypsum. The maximum shock pressure at the gypsum-glass boundary was 0.144GPa for the gypsum plate thickness of 4.93mm. The maximum shock pressure at the gypsum-glass boundary was 0.280GPa for the gypsum plate thickness of 4.28mm. When the shock wave passed through the gypsum with the thickness of 4.2mm and the glass thickness of 2mm and 5mm, the maximum value of the shock pressure was 0.191GPa and 0.179GPa, respectively.

The empirical equation of shock pressure and distance (r) from impact point was estimated from the antipodal velocities of gypsum plates. The shock pressure in gypsum attenuated in proportion of r^{-4}. We estimated the shock pressure in gypsum by using the shock pressure at the boundary between gypsum-glass and the Hugoniot of gypsum and glass. The estimated value in gypsum was lower than that at the boundary between gypsum-glass. Moreover, we investigated the shock pressure attenuation in glass. The shock pressure in glass attenuated in proportion of $r^{-1\sim-0.5}$. The decay rate of the shock wave in glass is sufficiently lower than that in gypsum. Therefore, we suggest that the attenuation of the shock pressure strongly depends on the gypsum region rather than on the glass region. So, the velocity distributions of fragments for the gypsum sample and the two-layered sample could be quite different.