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Static destruction experiments of porous materials

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As impact phenomena are commonly occurred in the solar system, it is important to understand impact phenomena of small bodies in order to study the origin and evolution of these bodies and the solar system. The scales of the impact phenomena in the solar system are far larger than we can address directly in the laboratory. Thus numerical simulations are effective to study the impact phenomena of the small bodies. However, numerical simulations require the physical properties of target material and should reproduce the results of the laboratory experiments. Therefore the laboratory studies of the physical properties of the target materials as well as the destruction experiments are important for numerical simulations.

In numerical simulations of collisional disruption of asteroids, a fracture model, Grady-Kipp model, was used (Benz and Asphaug, 1994). The Grady-Kipp model represents cracks statistically, by the nucleation and propagation of flows determined from an initial distribution. Benz and Asphaug (1994) predicted the shapes, locations, and velocities of the largest fragments in the laboratory experiments by a numerical simulation based on the Grady-Kipp model. On the other hand, more and more porous small bodies have been found in the solar system (Britt et al., 2002). Since crack-growth in a porous material is stopped by pores, it is not clear how far the Grady-Kipp model can be applicable in a simulation of porous materials.

In this study, we measure static compressive and tensile strength of sintered glass bead cylinders and disks whose porosity is about 40% and pumice whose porosity is about 72% and study the stress-strain state of the sample during the static loading. We will discuss how the porous samples are destructed.