Japan Geoscience Union Meeting 2011
(May 22-27 2011 at Makuhari, Chiba, Japan)

PPS022-11 Room:IC Time:May 27 09:00-09:15

A numerical model for the shape distribution of fragments in brittle targets

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Dynamic fragmentation is a complex physical phenomenon in many natural systems. The shape of fragments is one of the most interesting aspects of dynamic fragmentation. That is, in laboratory impact experiments, the shape of fragments over a broad size range is distributed around the mean value of the axial ratio 2: square root of 2: 1, which is independent of a wide range of experimental conditions. The shape distributions of the boulders on asteroid Eros and the small- and fast-rotating asteroids (diameter $<$200 m and rotation period $<$1h) are similar to those of laboratory fragments (Michikami et al., 2010). However, there are few studies to explain the shape distribution of fragments. No simple fragmentation model can reproduce the experimental shape distribution satisfactory. Many geometric approaches have focused on the size distribution of fragments. In this study, a geometric approach by numerical simulation has been performed, but we consider the effect of faults and the growth of cracks on the shape of fragments. Our model can reproduce the experimental shape distribution. The results show that the shape distribution is independent of target's shape, the growth of cracks and the number of inherent faults in the target.

Keywords: brittle target, shape of fragments, impact