A new technique to measure crater formation using a laser sheet

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Craters are universal and dominant on the surface of solid planets and asteroids. The realization of the importance of cratering has led to significant research on the various aspects of the cratering process, including the commonly used scaling rules (e.g. Holsapple [1993]). However, there are few experiments that measure the crater process directly. The most widely used method is the 'quarter space experiment' (e.g. Schmidt and Piekutowski [1983]). In such experiments, one wall of a target container is transparent and is used as an observation window. A projectile is impacted to the target along this window and cross-sectional views of a growing crater can be observed. In these experiments, however, the window may influence the crater flow field. Indeed, until now it has always been difficult to measure the growth of a crater cavity directly and non-intrusively. We have, therefore, developed a new technique using a laser sheet and a high-speed camera that directly observes crater growth without interferance.

As shown in Fig.1, we irradiate a target with a vertical laser-sheet. The laser-sheet provides an illuminated line on the target surface along the impact point. Launched by a single-stage light-gas gun, a projectile impacts the target to form a crater. Using our high-speed camera, we observe a series of snapshots showing changes in the laser line with time (Fig.2). By analyzing this line from the snapshots, we can obtain temporal changes in crater depth and diameter. Preliminary results confirm asymmetric growth in depth and diameter. We have also seen the crater depth rebound prior to the end of crater excavation. As part of this presentation, we will compare results using our technique with those obtained using the quarter space method.

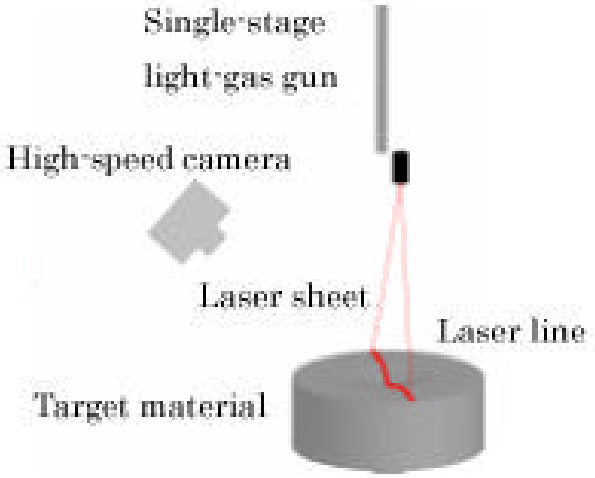

Fig. 1 Experimental setup

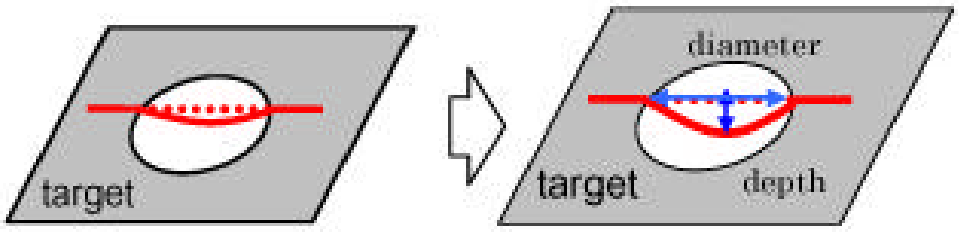

Fig. 2 Change of a laser position
(Camera view)