Laboratory experiment for impact melt generation in the impact crater

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The impact over 10km/s is common phenomenon in the Solar System. In such a condition, the complex phenomenon including rock melting and vaporizing happen. In fact, the rock melt is founded in the craters on the Earth and Moon. But the elementary process of generating melt is not known well because it is difficult to carry out hypervelocity impact in the laboratory experiment. We tried to show the process of generating melt, the process of flowing melt and the relationship between impact conditions and amount of melt by using the projectile accelerated with laser.

We carried out hypervelocity (over 10km/s) impact experiments on basalt. We succeeded to accelerate the projectile and conducted the target by using the high power laser in Institute of Laser Engineering Osaka University. The target is basalt from Kinosaki. Their sizes are 15-15-3mm or cube 15mm on a side. The projectiles are aluminum spheres which diameter is 0.1˜0.3mm. The impact velocity is 13km/s˜33km/s.

A number of craters were formed when the distance between the projectile and target is larger than 20mm. This suggests that the projectile breaks up between accelerating and flying. The rock melt were found in the crater and rim by using scanning electron microscope. The melt is glassy bubbly structure. The melt on the rim is probably floated out from floor of crater by gravity and consolidates on the rim. Then, we measured crater form in relatively large crater by laser displacement gauge. As a result, it is found that the crater depth is very shallow (depth/diameter=0.1). The reason why crater depth become shallow is probably that the pressure attenuation became large because of melting at impact point.