

Shock recovery of high-pressure phase of SiO₂ using high-power laser

*Tadashi Kondo¹, Hiromoto Kengo¹, Tatsuhiro Sakaiya¹, Hidenori Terasaki¹, Keisuke Shigemori², Youichiro Hironaka²

1. Department of Earth and Space Science, Graduate School of Science Osaka University, 2. Institute of Laser Engineering, Osaka University

High-pressure phases in meteorites provide us the important information of shock history in natural materials. Experimental approach to reproduce such high-pressure phase have been studied intensively mainly by light-gas gun so far, though shock condition with impact velocity beyond 10km/s is difficult. Recent technical progress of high-intensity laser as a tool of shock experiment realize the recovery of samples with shock condition above 10km/s(Nagaki et al.,2016). However, the limited shock duration time of about 10 nsec has been too short to drive structural conversion to high-pressure form in single crystal sample. In this study, we explored recovery condition of high-pressure phase of SiO₂ using finely ground samples of quartz, cristobalite and fused silica as starting materials. Laser shock experiments were performed using GXII hyper laser at Institute of Laser Engineering, Osaka University. The whole sample retaining relative locations in the recovered box made of aluminum was quenched without significant scattering in each run. The sectioned sample at shocked center were examined by optical microscope, micro-focused X-ray diffraction and SEM-EDS. We will report the characteristic feature of top portion of sample, which shows layered structure with different metamorphism, and distribution of grass and stishovite phase found in the samples shocked above 100GPa, which have still a residual stress to 10GPa in the ambient condition. We will discuss the dependence of the initial state of crystal to recover the high-pressure phase in shocked samples in nsec.

Keywords: shocked quartz, high-intensity laser, recovery experiments