Development of recovery technique of laser-shocked olivine

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It is important to investigate the recovered samples which are transformed by shock compression for understanding the origin of shock vein of chondritic meteorites. The high-pressure minerals in the meteorite are often recovered by the impact experiment of a light-gas gun up to 100 GPa. Although it is difficult to control higher pressure and temperature in the impact experiment, it is relatively easy to produce high pressure and temperature by high power laser such as GXII laser system at Institute of Laser Engineering, Osaka University. However, since the pulse width of the laser is very short (order of several nanoseconds) compared with the impact method with pulse duration of the order of 1 microsecond, the mechanism and kinetics of the transformation in laser-shocked materials have been poorly understood so far.

Therefore, we have been developed the recovery technique of the laser-shocked materials. We used single crystals of olivine from San Carlos as starting material which is a major constituent of meteorites and Earth's mantle. The deformation features, chemical composition and lattice structure of the recovered olivine were observed by optical microscopy, field emission-scanning electron microscopy with energy dispersive x-ray spectrometer, and micro-Raman spectrometer, respectively. We will report the results of these observations.