LASER-DRIVEN COMPRESSION STUDIES IN FUNCTIONAL MATERIALS

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We are studying a surface modification of functional material by using a laser-driven compression. A single shot of an ultra-intense laser with 0.43-0.45 J of energy and a pulse width of 110 fs (peak intensity of 0.71-1.73 x 10^{14} W/cm^2) are irradiated onto a single-crystal yttria-stabilized zirconia (s-YSZ, 10 mm-square, 0.5 mm-thick) and a highly oriented pyrolytic graphite (HOPG, 10 mm-square, 5 mm-thick). The laser-driven compression given to a sample is estimated 4.7-11.5 GPa with assuming the ponderomotive force [1,2].

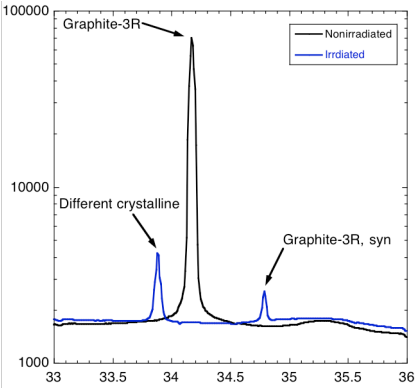

Fig. The X-ray diffraction profile from an irradiated HOPG. The energy of the used X-ray is 12.4keV, and the incidence angle of a sample is 10 degree. The different crystalline is observed in a HOPG.

We observed a structure of the sample by using a synchrotron X-ray diffraction (Aichi Synchrotron Radiation center; BL5S2). The X-ray diffraction observation results shows that an irradiation area is changed to micronize and polycrystalline in an s-YSZ [3].

In case of a HOPG, an X-ray diffraction-peak of the different crystalline is observed, as shown in Fig.1. This figure shows that a HOPG of layer-structure changes into a different crystalline structure with ultra-intense laser irradiation. This result is suggesting the method to generate a different crystalline structure into the original crystalline structures.

In this presentation, we describe detailed observation results of X-ray diffraction profile and diffraction image. We also show results that changed irradiation laser energy and surface condition.

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