

## Transparency of shock-compressed single crystal diamond

\*Kento Katagiri<sup>1</sup>, Norimasa Ozaki<sup>1,2</sup>, Kohei Miyanishi<sup>2</sup>, Yuhei Umeda<sup>1</sup>, Shintaro Morioka<sup>1</sup>, Takayoshi Sano<sup>2</sup>, Ryosuke Kodama<sup>1,2</sup>

1. Osaka University, 2. Institute of Laser Engineering, Osaka University

Carbon is one of the most prominent elements in nature and it is abundant in the Earth and many other planets. Diamond, a metastable phase of carbon, is naturally synthesized in deep inside of the Earth where substances are isotropically pressured. Diamond is known for its many unique properties such as high hardness, low compressibility, small thermal expansion coefficient, and transparency. Since it is important to understand how substances behave under high pressure, properties of compressed diamond have been measured in a wide range of pressures up to 5 TPa. However, the transparency of diamond under pressure has not been fully elucidated. Here, we report the measurement of the pressure dependency of the absorption coefficient of laser shock compressed single crystalline diamond. A high-intensity laser was utilized to shock compress the diamond sample along its  $\langle 100 \rangle$  direction, and velocity interferometer systems for any reflector (VISARs) were used to determine the absorption coefficient and pressure. It was found that single crystalline diamond remains largely transparent to the probe laser for VISAR ( $\lambda = 532$  nm) up to 140 GPa. The pressure dependence of the refractive index will also be discussed.

This experiment was conducted under the joint research of the Institute of Laser Engineering, Osaka University. This work was supported in part by JSPS KAKENHI grant No. 16H02246 and No. 16H01119. The part of work was also supported by Genesis Research Institute, Inc. (Konpon-ken, TOYOTA).

Keywords: Shock-compression, High intensity laser, Diamond, Transparency, Refractive index