FREQUENCY DOMAIN INTERFEROMETER WITH CHIRPED PULSE LASER FOR SHOCK DIAGNOSTICS

K.Ishii[1], Y.Nishimura[1, 2], Y.Mori[1], R.Hanayama[1], Y.Kitagawa[1], H.Azuma[3], T.Hioki[3], T.Nishi[3], T.Motohiro[3], O.Komeda[4], T.Sekine[5], N.Sato[5], T.Kurita[5], T.Kawashima[5], H.Kan[5], A.Sunahara[6], Y.Sentoku[7], E.Miura[8]

[1]The Graduate School for the Creation of New Photonics Industries, Hamamatsu, Japan
[2]TOYOTA Technical Development Corp., Toyota, Japan
[3]TOYOTA Central Research and Development Laboratories, Inc., Nagakute, Japan
[4]Advanced Material Engineering Div., TOYOTA Motor Corporation, Susono, Japan
[5]Hamamatsu Photonics K.K. 1820, Hamamatsu, Japan
[6]Institute for Laser Technology, Osaka, Japan
[7]Department of Physics, University of Nevada, Reno, NV, USA
[8]National Institute of Advanced Industrial Science and Technology, Tsukuba, Japan
ishii@gpi.ac.jp

An ultraintense short pulse laser induces a shock wave in a material, which compresses it. The pressure of shock compression is more than a few tens GPa. Velocity Interferometer System for Any Reflector (VISAR) has been widely used to measure the velocity of shock wave in material to estimate the pressure of shock compression [1]. The frequency domain interferometer with a chirped pulse laser can also be an interferometer with a temporal resolution of pico second [2]. To study the surface modification of functional materials due to the laser-driven shock compression, we have newly developed a frequency domain interferometer [3].

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) was irradiated onto materials, which drove strong shock waves into the materials. As a probe beam, we divided and picked up a part of the main chirped laser pulse with a pulse width 640 ps and wavelength from 812.3 nm to 789.1 nm. The chirp rate is 25.6 ps/nm. Our frequency domain interferometer has a 0.1nm wavelength resolution and then a 2.6 ps temporal resolution.

Figure 1 shows the interferograms from a mirror surface, instead of a target material surface. The optical path differences between the target and reference mirrors are 0, 0.5, 0.75, 1.0, 1.25, and 1.5 mm, respectively. The periods of the interferograms are 21.45, 2.83, 1.20, 0.635, 0.425, and 0.318nm, respectively. The interferometer has sensitivity of 10 μm.

In the presentation, we will describe the frequency domain interferometer system with a chirped pulse laser and show the results of the irradiation onto a single crystal yttria-stabilized zirconia (s-YSZ).

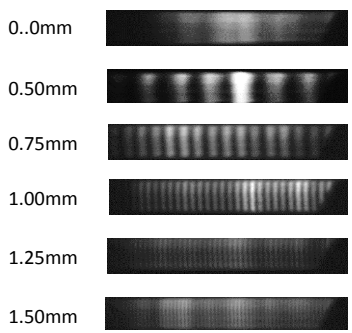

Fig.1. Interferograms of frequency domain interferometer from a mirror surface.

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