Ultrahigh pressure generation with laser-produced hot electrons

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We performed an experiment on ultrahigh pressure generation with hot electrons produced by high-intensity laser plasma interactions. Hot electrons with small temporal duration might be ultra-high pressure source by absorption of matter within very thin layer that is comparable to mean free path of hot electrons [1]. The ultrahigh-pressure generation exceeding GBar regime is very important for shock ignition scheme of ICF targets, as well as fundamental ultrahigh-pressure experiments.

Experiments were done on GEKKO-HIPER laser irradiation facility at ILE, Osaka University. We irradiated three-layered foils (CH-Cu-Quartz) in order to generate the ultrahigh pressure with hot electrons, and observe shock wave into the third quartz layer. The pulse duration and the intensity were 300 ps and 10^{16} – 10^{17} W/cm^2, respectively (ω light). We estimated laser intensity on the target with a static x-ray pinhole camera. The absorption area by hot electrons was measured by a Cu-Kα imager. The shock wave parameters were taken by VISAR and streaked optical pyrometer (SOP). The measured results indicate that the pressure due to hot electron is beyond 30 Mbar.

References

[1] S. Gus'kov, X. Ribeyre, M. Touati, J.L. Feugeas, P. Nicolai, and V. Tikhonchuk, Phys. Rev. Lett. 109, 1 (2012).