Optimization of a laser plasma-based X-ray source according to warm dense matter absorption spectroscopy requirements

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X-ray absorption spectroscopy (XAS) [1] diagnostic has been proved to be an effective tool for warm dense matter experimental studies. However, XAS requires a short-lived X-ray source of sufficiently high emissivity and absence of intense characteristic lines in a spectral range of interest. In our resent study [2], we discussed choosing its optimum material and thickness to get a bright source in the wavelength range of 2-6 Å (~2-6 keV) considering relatively low-Z elements. We demonstrated that the so-called photorecombination region of X-ray characteristic spectral emission is best suited for XAR using a laser-generated X-ray source, due to its featureless spectra of high intensity. Performed experiments showed that the highest emissivity of solid aluminium and silicon foil targets irradiated with a 1 ps high-contrast sub-kJ laser pulse of Vulcan PW laser facility is achieved when the target thickness is close to 10 μm. An outer plastic layer increases the emissivity even further [3].

References

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