Thickness determination of free-standing nm-targets

J. Braenzel[1a)], C. Pratsch[1,2], P. Hilz[3], C. Kreuzer[3], M. Schnürer[1] and H. Stiel[1,2], W. Sandner[1]

Max Born Institute Berlin, Germany

Technical laser development to ultrahigh laser contrast enabled the high field laser community to use ultrathin foil targets (below 200nm). The scientific interest in these ultrathin foils increased during the last years as theoretically predicted and experimentally found acceleration mechanisms beyond the Target Normal Sheath Acceleration (TNSA) process.

A key scenario is the Radiation Pressure Acceleration (RPA), which is still under scientific investigation – as it promises acceleration to higher ion energies as the TNSA process. For the RPA, targets thickness and density has to be scaled to the used laser intensity, therefore these are crucial parameters for the used freestanding foils.

We present a versatile and handy method allowing a thickness determination of freestanding thin plastic foils by its transmission characteristics in the EUV spectrum. The method is based on a laser induced plasma source, emitting light in the extreme ultraviolet (EUV) region. A compact double-mirror EUV monochromator selects sharpgly a fixed wavelength of 18.9nm and a CCD camera providing high dynamic range for transmission values with a standard deviation of $\Delta T = 0.005$. This enables foils thickness characterization with nm-accuracy at a given foil density and stoichiometric composition.

In comparism to height sensitve methods like AFM, confocal micrsopy or polymetry, the foil thickness can be determined and mapped directly on the freestanding foil[1], already mounted in the needed target holder for the laser plasma interaction experiment.

1. J. Bränzel, C. Pratsch, P. Hilz, C. Kreuzer, M. Schnürer, H. Stiel and W. Sandner, Review of Scientific Instruments **84** (5), 056109-056109-056103 (2013).