High resolution x-ray absorption spectroscopy using a laser-plasma radiation source

Ulrich Vogt, Thomas Wilhein

University of Applied Sciences Koblenz, RheinAhrCampus Remagen, Suedallee 2, D-53424 Remagen, Germany

Holger Stiel, Herbert Legall

Max Born Institute for Nonlinear Optics and Short Pulse Spectroscopy, Max-Born-Strasse 2a, D-12489 Berlin, Germany

The rapid development of laboratory sources for extreme ultraviolet (EUV) and soft x-ray radiation like laser produced plasmas, high harmonic radiation or x-ray lasers paves the way for applications which before mainly took place at synchrotron light sources. Although the average photon brilliance is normally higher at storage rings, the advantage of laboratory laser produced plasma sources is the potential for time-resolved experiments by pump-and-probe techniques [1,2]. The same laser pulse can be used for the generation of the visible pump pulse and x-ray probe pulse which makes the synchronization of the two pulses very easy. According to the method for x-ray generation time resolution in the range of few ns [3] down to few fs [4] or probably even less could be achieved. In this contribution we present results on near edge x-ray absorption fine structure spectroscopy (NEXAFS) at 284 eV (carbon K-edge) using a compact laser-plasma x-ray source [5]. The spectrometer works with a single x-ray optical element in grazing incidence configuration called off-axis reflection zone plate. Using different sample foils we were able to demonstrate a spectral resolution of E/(DeltaE)=600. The positions of specific absorption peaks are in agreement with data measured at synchrotron sources. Since the off-axis zone plate is a focussing system, the x-ray flux in the detector plane is high enough to record an absorption spectrum on a CCD detector with a single shot. In the single shot modus a spectrum can be recorded before a sample degradation takes place. This will enable time-resolved experiments using pump-probe techniques.

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