Laboratory system for optical coherence tomography (OCT) using a laser plasma source of soft x-rays and extreme ultraviolet and focusing ellipsoidal optics

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Optical coherence tomography (OCT) with the use of soft x-rays (SXR) and extreme ultraviolet (EUV) has been recently demonstrated [1-3]. This new imaging technique, termed XCT, enables the obtaining of cross-sectional and tomographic images of samples with nanometer spatial resolution. The article presents a newly developed laboratory system for XCT using a compact laser plasma light source operating in the SXR and EUV spectral ranges. Schematic od the setup and its view are shown in Fig. 1 and 2, respectively.

Fig. 1

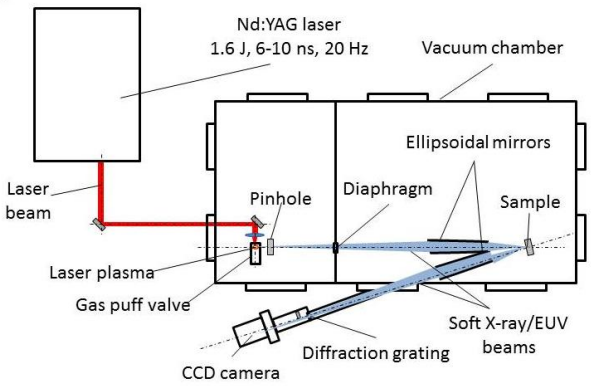
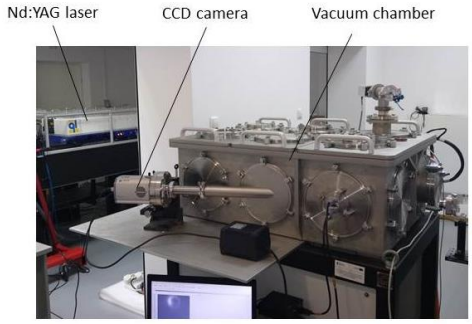


Fig. 2



The source is based on a double stream Kr/He gas puff target irradiated with nanosecond laser pulses from a Nd:YAG laser. The use of the gas puff target enables efficient emission of SXR and EUV radiation without generating target debris associated with laser ablation of a solid target. The source is equipped with an ellipsoidal mirror to collect radiation from the source and focus on the sample. The XCT measurements are performed by processing of spectra of radiation reflected from the sample measured with a transmission grating spectrometer equipped with an identical focusing mirror and coupled to a CCD camera. Characteristics of the source and the focusing optics are presented. The new XCT system was used for non-destructive testing of layered nanostructures. The preliminary results of the studies are demonstrated.

1. Fuchs et al. Sci. Rep. 6, 20658 (2016)
2. Fuchs et al. Optica 4, 903 (2017)
3. Wachulak et al. Sci. Rep. 8, 8494 (2018)