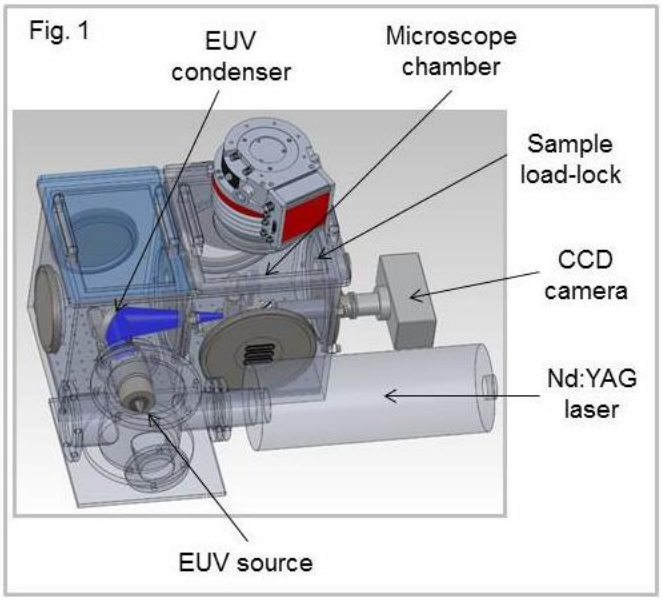
A desktop EUV microscope based on a compact laser-plasma light source with a gas puff target

Przemysław Wachulak[(1)], Alfio Torrisi[(2)], Andrzej Bartnik[(1)], Łukasz Węgrzyński[(1)], Tomasz Fok[(1)], and Henryk Fiedorowicz[(1)]

henryk.fiedorowicz@wat.edu.pl

(1) Institute of Optoelectronics, Military University of Technology, ul. Kaliskiego 2, 00-908 Warsaw, Poland
(2) Nuclear Physics Institute, Czech Academy of Sciences, 25068 Řež, Czech Republic

We report development of a very compact desk-top extreme ultraviolet (EUV) microscope based on a laser-plasma source with a double stream gas-puff target. The target is irradiated with nanosecond laser pulses from a commercially available Nd:YAG laser. As a result hot plasma emitting EUV radiation is generated. The use of the gas puff target allows efficient generation of EUV without target debris production. Schematic of the microscope and its view are presented in Fig. 1 and 2, respectively.



The microscope is equipped with an ellipsoidal condenser coated with Mo/Si layers to focus the radiation from the plasma onto the sample placed inside the microscope chamber. The microscope image is formed with the use of a Fresnel zone plate objective and a CCD camera. Quasi-monochromatic EUV radiation at 13.8 nm illuminating the object is obtained by spectral selection of a single line from the argon plasma emission using the ellipsoidal condenser. The microscope is capable of acquiring magnified images of objects with a spatial (half-pitch) resolution of sub-50 nm in a few seconds exposition time. Design details, development, characterization and optimization of the EUV source and the microscope are described and discussed. Test object and other samples were imaged to demonstrate superior resolution compared to visible light microscopy.