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# LASER PLASMA EUV SOURCE

## FOR MICRO- AND NANOPROCESSING OF POLYMERS

# E U V

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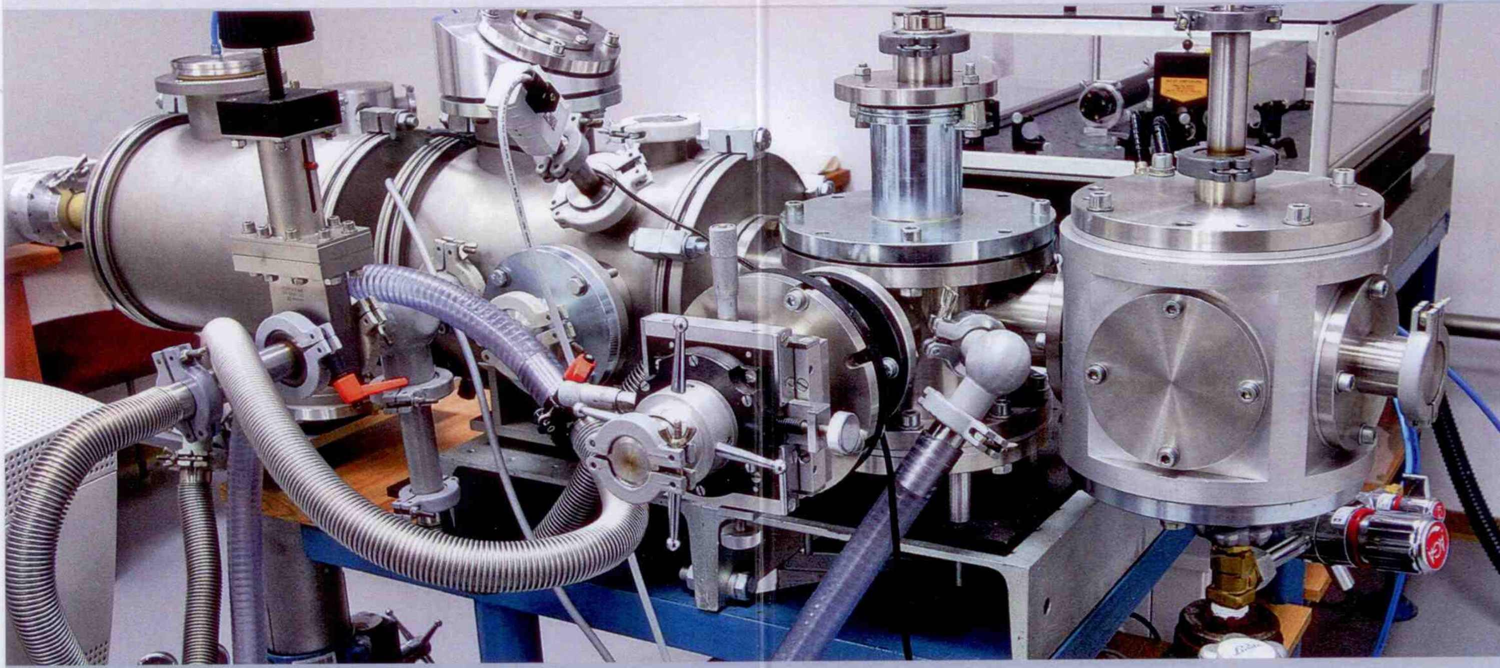

**The** extreme ultraviolet (EUV) regime extends from photon energies of approximately 25 to ~250 eV (corresponding to wavelengths from approximately 5 to 50 nm). Wavelengths in this range enable us to see smaller structures and write smaller lithographic patterns, therefore, the EUV range is highly attractive for application in nanotechnology. EUV radiation can be produced by synchrotrons. However, their limited number and very high investment costs imply that there is a strong need for development of a small-scale laboratory EUV source. We have developed a very compact, debrisless, and efficient laser plasma EUV source dedicated for micro- and nanoprocessing of polymers. The source is based on a plasma created from a laser-irradiated gas puff target. The target is irradiated with 4 ns laser pulses 4 ns and energies up to 0.8 J using a commercial 10 Hz neodymium-doped yttrium aluminum garnet (Nd:YAG). In result a hot plasma generating EUV radiation in the relatively broad spectral range from approximately 5 to 50 nm (with a strong maximum near 10nm) is produced. The source is equipped with a grazing incidence axisymmetric ellipsoidal mirror to focus EUV radiation onto the processed sample. The size of the focal spot is approximately 1 mm in diameter, with a maximum fluence of up to 100 mJ/cm2. The source can be used in processing polymers and modification of polymer surfaces. Modification of polymer surfaces is primarily caused by direct photo-etching with EUV photons and formation of micro- and nanostructures onto the surface. The interaction mechanism is similar to that of UV laser ablation, where energetic photons cause chemical bonds of the polymer chain to break. However, because of the very low penetration depth of EUV radiation, the interaction region is limited to a very thin surface layer (<100 nm). This makes it possible to avoid degradation of bulk material caused by deeply penetrating UV radiation. The laser plasma EUV source and a new technology of processing materials with EUV photons should be applicable in biomedical engineering for biocompatibility control of polymer surfaces.