Modeling of EUV source (λ=13.5 nm) for nanolithography based on laser or discharge produced plasma

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Modern extreme ultraviolet (EUV) light sources are necessary for the future lithography with much greater degree of packing for elements of integrated schemes (with details ~ 10 nm) than it becomes now. Such sources are based on plasma of tin, created by CO_2 laser or by means of the electric discharge, and have high efficiency, radiating up to 4 % from the input energy in an angle 2π in 2 % band of wavelengths close to 13.5 nm. Radiating plasma at density ~ 10^{20} $1/cm^3$ and at temperature ~ 50-100 эВ reaches tenfold ionization stage. It is optically thick, and radiation processes influence considerably the dynamics of plasma. For modeling EUV sources a new two dimensional Euler RMHD code RZLINE is developed. The code allows description of shock waves, including non-stationary ionization (recombination), electron and ion heat conductivity, pinch effects, magnetic field diffusion, Joule dissipation and nonequilibrium radiation transport. To calculate radiative phenomena we use newly developed code THERMOS-BELINE which makes possible self-consistent calculation of level kinetics and radiation transport for different plasma configurations. It includes: radiation transport of overlapped spectral lines with arbitrary optical thickness and realistic line profiles. Nonstationary ionization and nonequilibrium radiation effects are included on the basis of detailed atomic calculations. By means of the developed code EUV spectra for various experimental installations and initial conditions are calculated and compared with results of measurements.