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Plasma and Radiation Modelling of EUV Sources for Micro Lithograpy

Thomas Kr"ucken[1]

[1] *Philips Research Laboratories, Aachen, Germany*

Thomas.Kruecken@philips.com

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Future extreme ultraviolet (EUV) lithography will require very high radiation intensities in a narrow wavelength range around 13.5 nm, which is most efficiently emitted as line radiation by highly ionised heavy particles. Currently the most intense EUV sources are based on Xenon or Tin discharges. After having investigated the limits of a hollow cathode triggered Xenon pinch discharge a Laser triggered Tin vacuum spark discharge is favored by Philips Extreme UV.
Plasma and radiation properties of these highly transient discharges will be compared. Besides simple MHD-models the ADAS software package [1] has been used to generate important atomic and spectral data of the relevant ion stages. To compute excitation and radiation properties, collisional radiative equilibria of individual ion stages are computed. For many lines opacity effects cannot be neglected. The optical depths, however, allow for a treatment based on escape factors. Due to the rapid change of plasma parameters the abundancies of the different ionisation stages must be computed dynamically. This requires effective ionisation and recombination rates, which can also be supplied by ADAS.

[1] H. Summers et al., Atomic Data and its Utilisation at the Jet experiment, Plenum Press Series Physics of Photons and Molecules, Photon and electron collisions with atoms and molecules, edited by P.G. Burke, C.J. Joachain (1997), page 265; see also http://adas/phys/strath.ac