EUV LITHOGRAPHY

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EUV lithography with multilayer coated optics is presently the main contender for the fabrication of computer chips with dimensions below the 70 nm range after the year 2005, and several major tool suppliers are preparing to deliver prototype commercial steppers with that capability around the year 2003. Most of the technical developments that facilitated this scenario occurred during the last three years at the EUV LLC (Limited Liability Corporation), centered at three National laboratories (LLNL, SANDIA, and LBL) in the United States and funded by major semiconductor companies. Additional contributions are coming from the Extreme UV Concept Lithography Development System (EUCLIDES) program in Europe and the recently established ASET EUVL laboratory in Japan. We will describe the achievements of these programs and discuss remaining challenges. One major step has been the demonstration that aspheric, off-axis mirrors with figure and finish in the 1 Angstrom range can be measured, fabricated and aligned to produce near diffraction limited imaging. Reductions of the defects in the multilayer coatings to only a few per wafer is another major accomplishment. The multilayer deposition team has been able to coat mirrors up to 200 mm diameter with Mo/Si multilayers for λ = 13.4 nm with thickness profile errors of less than 0.1%. The aberrations introduced into the optics by these coatings are in the 0.1 Å range and can be ignored; one could even think of using this capability to improve the optical performance of a camera. The throughput required of commercial systems (80 wafers per hour) is a major challenge. Steppers that use a laser plasma source with Be-containing multilayers for λ = 11.4 nm. offer a 3-fold throughput increase over Mo/Si at λ = 13.4 nm. Studying the properties of Be containing multilayers, their stability, compatibility with mask patterning processes, growth parameters, and defect density is presently an important task.