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The year 2019 will mark the entry of extreme ultraviolet lithography (EUVL) into high-volume production of advanced semiconductor chips after 35 years of development. Although synchrotron sources are not being used for the commercial deployment of EUVL, synchrotron facilities have played and continue to play a vital role in the development and commercialization of EUVL. Modern EUVL, previously referred to as soft-X-ray projection lithography, was first demonstrated by H. Kinoshita of NTT in 1986 using synchrotron radiation and achieving 4 μm resolution [1]. Parallel development efforts were also in place at AT&T, which in 1990 demonstrated patterning down to 50 nm [2], again using synchrotron radiation. Spurred by these promising results, worldwide research and development in EUVL greatly accelerated, and today we have commercial tools powered by 250 W laser-produced plasma sources capable of pattering 145 300-mm wafers per hour at resolutions supporting the 7 nm node [3].

Despite EUVL entering high-volume production this year with 0.33 numerical aperture tools, many challenges remain to ensure the long-term extension of the technology to even higher resolution with numerical apertures of 0.55 and possibly wavelengths shorter than 13.5 nm. Synchrotron facilities will continue to play an essential research and development role as the community seeks to address these challenges.

In this special issue, we provide highlights from three synchrotron facilities currently most active in EUVL research: the Advanced Light Source at Lawrence Berkeley National Laboratory, NewSUBARU at the University of Hyogo, and the Swiss Light Source at the Paul Scherrer Institut. Certainly, there are many other crucial development efforts in place around the world, but in this special issue we specifically focus on synchrotron facility efforts. A broad description of the technology and the global efforts can be conveniently found in a variety of textbooks and EUVL conference proceedings [4–6].

The special issue also includes a contribution from ASML describing the ultra-high-power laser-produced light source to be used for commercial production. Despite synchrotrons having originally been considered as a leading candidate for commercial production with EUVL, the drastic increase in source power requirements over the decades has outpaced the capabilities of conventional synchrotron sources.

Finally, this special issue also includes a contribution from Intel describing the status and challenges facing EUVL in the realm of patterning materials. Patterning materials in general, and photoresists more specifically, have been called out by the International EUVL Symposium Steering Committee as the most significant challenges facing EUVL for both near-term high-volume manufacturing and for the long-term extension of EUVL technology [7]. As described in the Intel contribution, synchrotron facilities have a vital role to play in this area owing to the power of synchrotron techniques in the areas of photoelectron and chemical spectroscopy and imaging.

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