EUV Source for High Volume Manufacturing: Performance at 250 W and Key Technologies for Power Scaling *(Keynote Presentation)*

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This paper discusses the latest improvements in the performance of an EUV source for semiconductor lithography including power scaling and availability. EUV source performance has met the 250W targeted power level, significantly improved in dose stability, and increased in availability. The improvement in performance has been achieved due to implementation of the latest developments in EUV source subsystems including the tin droplet generator, CO_2 laser and control system.

This paper describes the development of laser-produced-plasma (LPP) extreme-ultraviolet (EUV) sources for advanced lithography applications in high volume manufacturing. We discuss the most recent results from high power testing on our development systems, and describe the solutions and technical challenges related to the implementation of these technologies. Subsystem performance will be shown including Master Oscilator Power Amplifier (MOPA) Pre-pulse operation with high Conversion Efficiency (CE) and dose control with low overhead and high die yield. We describe the most effective optimized modes of operation to control the plasma dynamics at high power and with the necessary collector protection. This presentation reviews the experimental results obtained on NXE:3400B sources with a focus on the topics most critical for a 250W HVM LPP source.

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Igor Fomenkov is an ASML Fellow in Technology Development Group in San Diego, California. After completing a Ph.D. in Physics and Mathematics at Moscow Institute of Physics and Technology (MPTI) in 1986, he joined General Physics Institute as a senior scientist, where he worked in the field of interaction of high intensity laser radiation with matter and diagnostics of laser produced plasma. He joined Cymer in 1992 and worked on the development of high power, high reliability KrF and ArF Excimer lasers for DUV (at 248nm and 193nm) microlithography. Since 1997 he has been conducting research and development of sources for Extreme Ultraviolet Lithography at 13.5nm. He was appointed Cymer Fellow in 2003 and ASML Fellow in 2014. He has authored over 50 technical papers and holds over 100 patents in the areas of DUV and EUV light sources.