Advances in Multi-Beam Mask Writing

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The race to shrink commercially available technology, down to the 7 nm technology node and beyond, boosts the demand for Mask Writer tools with high printing quality at < 1 day writing times for leading-edge masks. Sophisticated Resolution Enhancement Techniques, like Optical Proximity Correction and Inverse Lithography Technology, lead to smaller and more complex patterns on masks for 193nm immersion Optical and Extreme Ultra Violet Lithography, and on master templates for Nano-Imprint Lithography. For Variable Shaped Beam Mask Writers, the complexity of the pattern significantly increases the shot count in exposures, correlated to > 1 day writing time for sub-10nm masks. In Multi-Beam Mask Writers, the number of shots, and therefore writing time, is independent of the pattern complexity to be printed on 6" mask blanks. After 7 years of development, the first commercially available Multi-Beam Mask Writer tool MBMW-101 has been introduced by IMS Nanofabrication last year. The writer, operated with 262-thousand programmable beams, meets resolution and pattern placement criteria for the 7 nm node at a write time of less than 10 h per mask using a 120 Gbit/s data path and total electron beam current of up to 1 µA. Ongoing developments for Multi-Beam Mask Writing have produced further performance data which shall be presented.