Lawrence Berkeley National Laboratory

Lawrence Berkeley National Laboratory

Title

Mask Shadowing and the Line-edge Transfer Function

Permalink

<https://escholarship.org/uc/item/97b4t2dr>

Author

McClinton, Brittany

Publication Date

2012-03-30

Mask Shadowing and the Line-edge Transfer Function

Brittany McClinton, University of California Berkeley

Owing to the mask-side non-telecentricity resulting from the reflective nature of extreme ultraviolet lithography (EUVL), mask shadowing is well-known to be an issue for EUVL. The shadowing problem is also expected to become more severe as numerical apertures are increased in the future and even larger mask illumination angles become required. Although the shadowing problem in general has been well studied, the impact this effect might have on the transfer of line-edge roughness (LER) from the mask to the wafer has not been studied. Here we extend previous efforts in the analysis of the LER transfer function (LTF) to explicitly include 3D mask effects. We show that the LTF differs for the shadowed and non-shadowed directions: moreover, the LTF of the left-side edge differs from the right-side edge in the shadowed direction. Finally, we also observe a breakdown of the linearity of the LTF for shadowed features.

DISCLAIMER

This document was prepared as an account of work sponsored by the United States Government. While this document is believed to contain correct information, neither the United States Government nor any agency thereof, nor The Regents of the University of California, nor any of their employees, makes any warranty, express or implied, or assumes any legal responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by its trade name, trademark, manufacturer, or otherwise, does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof, or The Regents of the University of California. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States Government or any agency thereof or The Regents of the University of California.

This work was supported by the Director, Office of Science, of the U.S. Department of Energy under Contract No. DE-AC02-05CH11231.