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Materials Design

MATERIALS GENOME INITIATIVE SEMINAR SERIES

Combining X-Ray Scattering and Materials Modeling for Directed Self Assembly Morphology Measurements

Dr. Joseph Kline
Materials Science and Engineering Division,
Functional Polymers Group, NIST

April 30, 2015 (Thursday) | 9.00am
CHiMaD, Hogan 1160 (1st Floor)

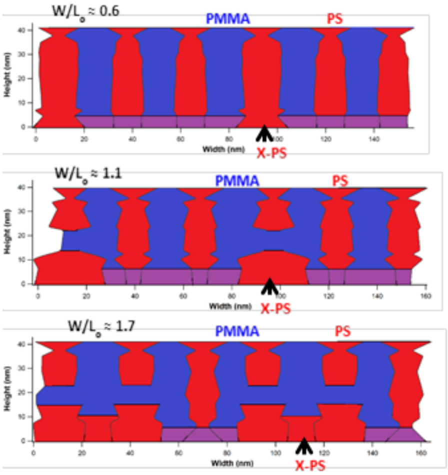
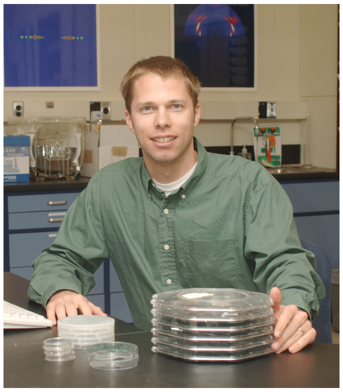


Fig. 1 – 2D shape profiles determined for 3 different template conditions for PS-b-PMMA.

ABSTRACT The semiconductor industry is pushing the limits of conventional optical lithography. Directed self assembly (DSA) of block copolymers (BCP) is one of the leading candidates for extending lithography to ever smaller features sizes. One of the critical questions remaining for BCP-based lithography is the buried structure and potential 3D defects not visible with surface characterization methods such as SEM and AFM. We have developed a scattering method using resonant soft X-rays to determine the buried shape of the BCP interface in samples that otherwise have no contrast. We solve the shape using an inverse, iterative method to create trial shapes and match their simulated scattering to the data. The shapes determined from the measurement match theoretical predictions for a series of different processing conditions. The inverse, iterative method is computationally demanding and limits the models to simple shapes with a small number of parameters. We are currently working to directly integrate the materials modeling into the fitting of the scattering data to allow the determination of more complicated, physics-constrained shapes including 3D information about the BCP structure. Additionally, the integration of scattering data into materials models will help constrain the modeling space to structures consistent with the measured samples.



***R. Joseph Kline** currently leads the Dimensional Metrology for Nanomanufacturing project at NIST. His research interests include the development and application of synchrotron-based x-ray diffraction and scanned probe microscopy for morphology characterization of organic semiconductors, and x-ray based dimensional metrology of nanostructures for the semiconductor industry. He received a Ph.D. in Materials Science and Engineering from Stanford University in 2005. He has published more than 60 articles, 4 book chapters, and given more than 30 invited presentations. He was recently awarded the Presidential Early Career Award for Science and Engineering.*

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