Abstract Submitted
for the MAR06 Meeting of
The American Physical Society

Directed Diblock Copolymer Self-Assembly Using Engineered Topologies To Drive Defect Motion. RICARDO RUIZ, CHARLES BLACK, ROBERT SANDSTROM, IBM T.J. Watson Research Ctr. — Self-organizing materials hold great promise for delineating the critical nanometer-scale elements of future integrated circuits. While self assembly provides a pathway to defining sub-lithographic dimensions, its Achilles heel lies in minimizing defects. Unlike lithographic processes, self assembly involves optimization of thermodynamic free energy, which can require prohibitively long equilibration times and may never reach pattern perfection. We have begun to address this intrinsic limitation by engineering surfaces to influence the assembly process. In this way we eliminate defects in the critical device areas, while driving unavoidable imperfections to predefined, non-crucial regions. We discuss this approach within the context of lamellar-phase poly(styrene-b-methylmethacrylate) diblock copolymer films, which possess excellent material characteristics for use as lithographic templates. Understanding the dynamics of pattern formation in these materials is crucial to optimizing their performance. We use correlation length measurements of lamellar diblock copolymer domains to extract information about mechanisms of defect annihilation. We also quantify the quality of these self-assembled materials within a framework of resist performance metrics, including resist profile, line-edge roughness, and etch characteristics.

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Date submitted: 30 Nov 2005 Electronic form version 1.4