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**Neutron and X-ray Characterization of Nanostructured Polymeric Materials**[1]

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Controlling the orientation and lateral ordering of the block copolymer microdomains is key to their use as templates and scaffolds for the fabrication of nanostructured materials. Processes must be robust, rapid and simple to implement and should not introduce disruptive processing steps that would impede their use. Grazing incidence small angle x-ray scattering (GISAXS) and neutron neutron scattering have proven to be critical for the characterization of the static and real time development of structure in thin films of block copolymers. Here, studies on poly(styrene-b-4-vinylpyridine) (PS-b-P4VP) diblock copolymers prepared from mixed solvents will be discussed that show highly oriented, cylindrical microdomains with a high degree of lateral order on a wide range of substrates, including silicon oxide, polystyrene, germanium, polyimide, and poly(butylene terephthalate). The preferential solvation of the P4VP block with an alcohol was used to induce a reconstruction that left a nanoporous film upon drying. The evaporation of gold onto the reconstructed films produced thermally stable films that are resistant to reactive ion etching. GISAXS was used to quantitatively examine the structure of these composite films and the transfer of the patterns to the underlying substrate. (research done in collaboration with Soojin Park, Jia-Yu Wang, Bokyung Kim University of Massachusetts), Benjamin Ocko (Brookhaven National Laboratory) and Jin Wang (Argonne National Laboratory).

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