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ATRP-derived functional polymers for electronic applications

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University of Texas at Austin — Traditionally, the controlled synthesis of functional polymers has been challenging due to the incompatibility of chemical functional groups with the propagating active centers during polymerizations. This barrier, however, has been overcome with the development of atom transfer radical polymerization (ATRP). Using this technique, in combination with ring-opening polymerization, we have successfully synthesized well-defined block copolymers containing poly(pentafluorostyrene) (PPFS) and polylactide (PLA). Acid-catalyzed degradation of the PLA block yields PPFS films with nanoscale pores whose size and spacing are tunable through control of the diblock copolymer molecular weight and composition. The introduction of porosity to PPFS films lowers the dielectric constant, useful as isolation for interconnects. In addition, we used ATRP to synthesize well-defined homopolymers of and block copolymers containing poly(2-acrylamido-2-methyl-1-propanosulfonic acid). We used these polymers as templates for the subsequent polymerization of aniline (PANI) to create water-dispersible, directly patternable polymer conductors for thin film electronics. We can tune the conductivity of PANI through control over the molecular characteristics of the polymer acid template.

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