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Role of Acid Functionality and Placement on Morphological Evolution and Strengthening of Acid Copolymers LURI ROBERT MIDDLETON, ERIC SCHWARTZ, KAREN WINEY, University of Pennsylvania — Functional polymers with specific interactions produce hierarchical morphologies that directly impact mechanical properties. We recently reported that the formation of acid-rich layered morphologies in precise poly(ethylene-co-acrylic acid) copolymers improves tensile strength. We now explore the generality of this phenomenon through variations in pendant acid chemistries, acid content and precision in placement of acid groups in polyethylene-based copolymers. In situ X-ray scattering measurements during tensile deformation reveal that the precision in acid group placement is critical to forming well-defined layered morphologies. This phenomenon was observed in both semi-crystalline and amorphous precise acid copolymers with varied acid chemistries (acrylic, geminal acrylic and phosphonic acids). Compositionally identical polymers but with pseudo random acid placement do not form layered morphologies. Acid chemistry and acid content influence morphological evolution predominately though modification of the copolymer Tg and crystallinity. Our results indicate that hierarchical layered structures, commensurate with improved mechanical properties, form in the presence of uniformity in chemical structure and sufficient chain mobility to strongly align during deformation.

Luri Robert Middleton
University of Pennsylvania

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