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Morphological Control of Segmented Polyurethanes via Crystallization Confinement of Soft Segments MATTHEW HOOD, BINGBING WANG, JOHN LASCALA, JAMES SANDS, FREDRICK BEYER, JOSH ORLICKI, MARK VANLANDINGHAM, CHRISTOPHER Y. LI, U.S. ARL COLLABORATION — Segmented polyurethane (SPU) is a linear, high molecular weight block copolymer comprised of regions of soft and hard segments. The phase separation between these mechanic-contrasting segments is partly the cause of SPU's superior mechanical strength as the hard domains reinforce the soft domains, while the soft domains provide the toughness that allow for good energy adsorption. To achieve the greatest impact absorption the soft segments must remain amorphous surrounding the crystallized hard domains which are held together via hydrogen bonding. We systematically investigated a SPU system with poly(ethylene glycol) (PEG) of various molecular weights as the soft segments. Using differential scanning calorimetry, small angle X-ray scattering and wide angle X-ray diffraction it was observed that as hard segment content increased there was a decrease in soft segment crystallization till PEG crystallization was no longer observed, thus achieving the desired structure. By tailoring the composition it is also possible to control the nano-sized structure altering the morphology on the macro-scale thus increasing the interface density of the SPU such that we produce a transparent film possessing structural capabilities suitable for transparent body armor.

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