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Use of Taylor Rod-on-Anvil Impact Experiments to Investigate High Strain Rate Behaviour in Polyolefins DAVID BUCKNALL, AMANDA LUCE, ABHIRAM KANNAN, JENNIFER BREIDENICH, NARESH THADHANI, Georgia Institute of Technology — The high strain rate deformation and mechano-lumination of various polyethylenes and polypropylene is studied using Taylor rod-on-anvil impact testing. Polypropylene and low density (LDPE), high density (HDPE), and ultra high molecular weight (UHMWPE) polyethylene samples were impacted against a hardened steel anvil at velocities ranging from 50-500 m/s. High-speed imaging, time-resolved spectroscopy, and thermal imaging are employed to track the macroscopic shape change and observe mechano-lumination and heating during impact. Additionally, electron spin resonance (ESR) and gel permeation chromatography (GPC) measurements were performed on recovered impacted samples to explain the observed deformation behavior in the various polyolefins. Time-resolved spectroscopy, coupled with ESR and GPC measurements indicate that chain scission occurs during the first few microseconds of the impact event. The observed macroscopic deformation that occurs after the observed mechano-illumination event is therefore influenced by the loss of mechanical strength associated with a drop in the molecular weight of the polymer.

Jennifer Breidenich
Georgia Institute of Technology

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