Abstract Submitted
for the MAR14 Meeting of
The American Physical Society

Extensional Flow Induced Crystallization of Polyethylene DAVID NICHOLSON, Massachusetts Institute of Technology, C. REBECCA LOCKER, ANDY TSOU, ExxonMobil Research and Engineering Company, GREGORY RUTLEDGE, Massachusetts Institute of Technology — The majority of manufactured polyethylene is used in films mostly through the blown film fabrication process where extensional flow induced crystallization is a critical component in affecting the development of crystalline morphology and amorphous topology. In order to optimize the blown film performance, it is critical to understand the mechanism of extensional flow induced crystallization of polyethylene. Model high density polyethylene with a M_n of 20,000 g/mol and a PDI (polydispersity) of 2 and lower were synthesized by organometallic catalysts. Extensional flow induced crystallization of these materials was measured using the SER (Sentmanat Extensional Rheometer) either at a given rate with varying temperatures or vice versa. A continuum model was applied to analyze the flow induced crystallization data. All samples after extensional flow were quenched in ice water and the resulting morphology was characterized using SAXS and WAXS. The extensional rate was found to be effective in modifying morphology whereas the temperature was not; neither temperature nor strain rate affected the final film crystallinity. With an increase in extensional rate, crystallites became thinner and narrower with potentially higher connectivity which could lead to higher toughness.

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Date submitted: 15 Nov 2013 Electronic form version 1.4