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Morphological Determinants of Yield Stress for Semicrystalline Ethylene / Methacrylic Acid Copolymers ROBERT SCOGNA, RICHARD REGISTER, Princeton University — Reducing the crystal thickness of ethylene/α-olefin copolymers typically results in a decrease in the measured yield stress. However, statistical incorporation of methacrylic acid, also a noncrystallizable comonomer, actually increases the yield stress at room temperature. The yield stress for ethylene/methacrylic acid (E/MAA) copolymers as a function of temperature and test rate is described using a model which accounts for polyethylene crystal plasticity through thermal nucleation of screw dislocations in addition to the effects of incomplete relaxation of the amorphous fraction at the strain rate employed. This is possible using a small number of physically reasonable best-fit parameters. Yield stress master curves can be constructed for any material that obeys the model; such curves have been constructed for a low-density polyethylene and five copolymers of varying MAA content from data taken at various strain rates and temperatures. The master curves clearly show that this unusual behavior of the yield stress is caused by the increase in β relaxation temperature with increasing MAA content, as seen via dynamic mechanical testing.

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