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Micromechanics of Yielding for Ethylene / Methacrylic Acid Ionomers. ROBERT SCOGNA, RICHARD REGISTER, Princeton University — Partially neutralizing an ethylene/methacrylic acid copolymer (E/MAA) with either sodium or zinc leads to an increase in the yield stress, by an amount which increases with the level of neutralization. This is a direct consequence of increasing nanoscale heterogeneity: the formation of ion-poor and ion-rich domains within the amorphous phase of the ionomer. This segregation is evident by dynamic mechanical testing, which reveals that, upon neutralization, the β relaxation peak of an unneutralized E/MAA copolymer splits into two parts which represent the relaxations in ion-poor and ion-rich regions. Though both sodium and zinc cations are capable of producing this segregation, the critical degree of neutralization required to produce the split relaxation is higher for zinc. The ion-poor relaxation occurs near the T_g of low-density polyethylene while the temperature of the ion-rich relaxation increases monotonically with the degree of neutralization. Thus, increasingly higher temperatures or lower strain rates are needed to fully relax the ion-rich domains as the neutralization level is increased, resulting in the higher measured yield stress.

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