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Generalized Ferroelectricity in the Mesomorphic Phase of Nylon Polymers ZHONGBO ZHANG, LEI ZHU, MORTON LITT, Case Western Reserve Univ — Novel ferroelectric polymers, featured by narrow electric displacement-electric (D-E) hysteresis loop, are attractive for electric energy storage applications due to their high dielectric constant and low loss property. Currently, only poly(vinylidene fluoride) (PVDF)-based copolymers (e-beamed) and terpolymers show novel ferroelectric behavior. It is desired to achieve novel ferroelectricity in other polymers such as nylons by carefully modifying the chemical and crystal structures. In this presentation, isomorphic crystals are successfully achieved by copolymerization of nylon 11 and nylon 12 with different compositions. In this way, both chemical and structural defects (i.e., dangling amide groups and kinked bonds) are introduced into the mesomorphic phase. As a consequence, hydrogen bonding interaction is successfully weakened and thus enhanced ferroelectricity with higher maximum polarization and better polarizability is obtained. In addition, for the purpose of further disturbing the mesomorphic phase and pinning effect, partially methylated nylon copolymers are synthesized. With the help of N-methylation of amide groups, the methylated nylon copolymers show relatively narrow hysteresis loops, suggesting the pinning effect from the N-methylated amide moieties.

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