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Large Deformation Mechano Optical Behavior of Poly Ethylene Napthalate Nanocomposites

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Non-Linear Mechano-Optical behavior and structural organizational processes of Polyethylene Naphthalate nanocomposites are investigated under uniaxial deformation in rubbery state. The stress-optical behavior of PEN nanocomposites under large deformation revealed that there are three distinct stress-optical regimes with an additional glassy component appearing at low temperatures. The final structure and deformation behavior of the blends have been mapped out in a dynamic phase diagram showing that the material undergoes a series of critical structural transitions. The Nanocomposites were found to undergo two critical structural transitions: i) Nematic-crystalline transition wherein the material stretched below a certain temperature do not undergo orientation-induced crystallization but develops a highly ordered nematic state. ii) Liquid-Liquid (Tll) transition wherein the material transforms from a fixed liquid to a true liquid state at 1.25 times Tg(°C) or 1.07 times Tg(°K), exhibited by the disappearance of the initial glassy component as the material becomes devoid of the inherent structure due to segmental correlations. The presence of nanoplatelets was found to facilitate strain induced crystallization even at such high temperatures primarily as a result of its suppression of relaxation mechanism in their region of influence.