A Theoretical Consideration of the Drawing Stress in the Semicrystalline Polymer

성 우 경,* 주 창 환, 임 승 순

한양대학교 공과대학 섬유공학과

* 포항 공과대학 물리학과

An attempt was made to evaluate quantatively the drawing stress (necking stress) of semicrystalline polymer. On the basis of thermo-dynamical concept and two-phase structural model, the drawing stress (σ_D) is expressed as follows:

$$\sigma_D = (1/\Delta\lambda)\rho [C\Delta h_m (1 - T/T_m) - (1-C) T\Delta S_a]$$

where Δh_m and ΔS_a are the enthalpy change of crystalline component at melting temperature and entropy change of amorphous component, respectively, T is the drawing temperature, T_m is melting temperature, C is the crystalline fraction, ρ is the mass density of material, and $\Delta\lambda$ is strain difference during necking. Experimental verification were partially conducted for the system of high-density polyethylene (HDPE) and low-density polyethylene(LDPE).