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High Strength Development at Incompatible Semicrystalline Polymer-Polymer Interfaces[1] C.H. HONG, RICHARD WOOL, University of Delaware — For incompatible A/B interfaces, the strength G_{1c} is related to the equilibrium width w (normalized to the tube diameter) of the interface by G_{1c}/G^* = (w-1), where G^* is the virgin strength [R.P. Wool, C.R, Chimie, 9 (2006) 25]. However, the interface strength is quite weak due to very limited interdiffusion. The mechanism of high strength development of a series of thermoplastic polyurethane elastomers (TPU) bonding with ethylene vinyl alcohol copolymers (EVOH) was investigated. During cool down of the A/B interface in the co-extruded melt, there exits a unique process window—the $\alpha - \beta$ window-which promotes considerable strength development. We used the differences in melting points and the volume contraction during asymmetric crystallization to generate influxes (Σ nano-nails/unit area), where an influx occurs by the fluid being pulled into the crystallizing side. TPU samples with higher degree of crystallization typically exhibited higher peel strengths, due to the formation of both inter- and intra- spherulitic influxes of nano-dimension across the interface. The peel energy now behaves as $G_{1c} \sim \Sigma L^2$, where L is the length of the influx and L>>w. Annealing between the α and β t relaxation temperatures of the EVOH generated additional influxes which provided significant connectivity and peel strength.

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