Abstract Submitted
for the MAR09 Meeting of
The American Physical Society

Pseudobrush theory of amorphous interphase in semicrystalline polymers. SCOTT MILNER, Penn State University — The conformation of polymer chains emerging from the face of a crystalline lamella has long been a matter of dispute. Long ago, arguments pitted "adjacent reentry" versus the "switchboard model" as extreme limits of possible behavior. Later, two theoretical approaches were attempted, but one (the Gambler's Ruin model) did not properly account for the constraint of melt density, and the other (heuristic configuration counting of Flory et al.) did not account for chain connectivity. These shortcomings are resolved by a new "pseudobrush" theory of the amorphous interphase, which represents the reentrant chains as a polydisperse brush of loops in a self-consistent hydrostatic pressure field. This theory predicts the fraction of adjacent reentry, shows how the anisotropy of the interphase dies away with distance, and how the Gambler's Ruin model is recovered far from the interface. Extension to the case of a finite slab between two crystal-melt interfaces predicts the frequency of tie chains, a key parameter for nonlinear deformation and ductile failure of semicrystalline polymers.

Scott Milner
Penn State University

Date submitted: 20 Nov 2008 Electronic form version 1.4