Abstract Submitted
for the MAR07 Meeting of
The American Physical Society

Crystallization-induced fluid flow in polymer melts undergoing solidification[1] ZHIGANG WANG, DONGHUA XU, CAS Key Laboratory of Engineering Plastics, Institute of Chemistry, CAS, Beijing, 100080 PR China, JACK F. DOUGLAS, Polymers Division, NIST, Gaithersburg, Maryland 20899 USA, KLEP TEAM, NIST TEAM — The formation of 'plastic' polymer materials often occurs under confinement where high pressure imprinting or casting in a mold are involved. To gain insight into this highly non-equilibrium process, we examine the nature of fluid flow that occurs in the non-crystallized regions of melts during spherulitic crystallization by following the movement of tracer particles in isotactic polypropylene films using optical microscopy. We observe a relatively rapid (average particle velocity 13 μm/min at 138 ^{o}C, compared to a spherulite growth rate of 0.86 μm/min) particle movement in the melt until the spherulites become geometrically percolated. We interpret this transient flow to arise from the buildup of local stresses under confinement. Crystallization-induced fluid flow is expected to significantly influence crystal morphology, defect formation and ultimate properties of materials forming by injection molding, pressure imprinting and other processing involving both polymeric and non-polymeric materials where crystallization occurs under confinement.

[1]Supported by Hundred Young Talents Program of CAS and NSFC 10590355.

Zhigang Wang
KLEP, Institute of Chemistry, CAS, Beijing, China

Date submitted: 16 Nov 2006 Electronic form version 1.4