Abstract Submitted
for the MAR05 Meeting of
The American Physical Society

Polymer Nanocomposites Made by Solid-State Shear Pulverization: Achievement of Well-Dispersed Nanofiller Sheets, Nanotubes, and Nanoparticles KOSMAS G. KASIMATIS, LAURA M. DYKES, WESLEY D. BURGHARDT, RAMANATHAN THILLAIYAN, L. CATHERINE BRINSON, Northwestern University, Evanston, IL 60208, RODNEY ANDREWS, University of Kentucky, Lexington, KY 40506, JOHN M. TORKELSON, Northwestern University, Evanston, IL 60208-3120 — A major stumbling block in the field of nanocomposites concerns the achievement of excellent nanofiller dispersion or exfoliation in various polymers using a scalable, industrially applicable process that mixes polymer and nanofiller directly, without need for solvent or polymerization of monomer. Unfortunately, the production of polymer nanocomposites by twin-screw melt extrusion has met with relatively little success, with positive results limited to a subset of polar polymers such as nylon-6. Here we demonstrate that a novel, continuous process called solid-state shear pulverzation (SSSP) can obtain substantially higher levels of dispersion or exfoliation than melt processing for a range of nanofillers, including clay (silicate) sheets, multiwall carbon nanotubes, and alumina nanaparticles. Characterization has been undertaken by electron microscopy, x-ray scattering, differential scanning calorimetry (crystallization kinetics and physical aging behavior), thermogravimetric analysis, dynamic mechanical analysis, rheometry, and impedance spectroscopy.

John M. Torkelson
Northwestern University

Date submitted: 27 Nov 2004 Electronic form version 1.4