

## **60c Laboratory Demonstrations on Structure and Transport in Polymer Nanocomposites**

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Laboratory demonstrations on polymer nanocomposites have been prepared for a senior level undergraduate course on processing of polymers and composites. The nanocomposite specimens were prepared by dispersing nanoscopically thin, silicate layers or expanded graphite in nylon-6. Films have been prepared from the nanocomposites and characterized for nanolayer orientation with the help of a prism coupler and also for oxygen permeability with the help of a MOCON instrument. Injection molded bars were also prepared to measure the electrical resistivity of the nanocomposites. The demonstrations were supplemented by a lattice simulation to illustrate percolation concepts and the effects of length and orientation on the percolation threshold. Some of these demonstrations were also used in an industry workshop run at Michigan State University. These demonstrations help students develop an appreciation of the changes in transport properties that can be brought about by strategically dispersing small amounts of highly anisotropic and nanoscopically thin filler in polymeric materials. Students taking this course learn to use standard characterization techniques such as differential scanning calorimetry and dynamic melt viscosity tests to investigate nanoscale effects and the structure. They will also learn to relate the loading of layered silicates or expanded graphite and the mean particle aspect ratio in the nanocomposites to particle orientation, polymer crystallization and the diffusivity of gases as well as the electrical impedance.