NSF Award in Mathematical and Physical Sciences

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- **Project:** Rheo-X-Ray Investigation of Structure Development in Polymer Melts Under Uniaxial Extensional Flow
- **Start Date:** September 1, 2009
- **Total Award Amount:** $440,000

**How the results of this project will benefit society:**
The instrumentation developed under this proposal will open new vistas of scientific inquiry in virtually every class of polymer material that has been the object of flow-induced structure studies. The instrumentation will be made available to researchers across the country, thus making a permanent contribution to American scientific infrastructure.

**The problem the project is trying to solve:**
Much of the vast plastic materials industry hinges upon changes in molecular structure induced in processes such as fiber spinning, extrusion and molding, which are essential to achieve the desired performance in the end product. X-ray scattering is a powerful tool for in-situ structural studies during both flow and processing. To date, however, x-ray scattering methods have never been applied to well defined, homogenous extensional flows.

**How this project will work:**
Using powerful x-rays at the Advanced Photon Source at Argonne National Laboratory, researchers from Northwestern University will develop a unique new instrument that will enable molecular-scale structural changes to be studied in extensional flows in which molten plastics are stretched much in the same way that taffy is pulled. Extremely bright x-ray beams will facilitate real-time measurements of nanometer-scale structural dynamics in a wide range of high-performance materials.

This award is funded under the American Recovery and Reinvestment Act of 2009, NSF Award number: 0907068.