RHEOLOGY SOLUTIONS
MOLECULAR WEIGHT AND SHEAR THINNING PROPERTIES
OF POLYMER SYSTEMS

PROBLEM
Polymer systems are often characterized by Melt Index or Melt Flow values. These numbers reflect the amount of material which flows through a capillary under a standard set of conditions (temperature, pressure and time). This flow information is qualitatively related to sample viscosity (at the test conditions) and molecular weight; i.e., less flow indicates higher molecular weight and higher viscosity, and more flow indicates lower molecular weight and lower viscosity. Since the applied force (or applied stress) is constant for each material tested, samples with different flow values (different viscosities) are actually being measured at different shear rates. This approach may not be satisfactory for all processors of polymer systems.

SOLUTION
Information characterizing both the molecular weight level and shear thinning properties of polymer melts can be obtained using a Controlled Stress Rheometer. Creep tests can be used to quantify the low shear rate (Newtonian plateau region) viscosity. This value is representative of a material's molecular weight (the higher the plateau value, the higher the molecular weight). An indication of shear thinning properties can be obtained through use of oscillatory tests over a range of frequencies. Using the Cox-Merz Rule (1), creep and oscillatory data can then be combined to provide viscosity as a function of shear rate information over a wide range of shear rates. This approach provides the broader range of information needed by a processor to characterize polymer systems. Figure 1 illustrates the data obtained for a low and high melt flow ethylene vinylacetate copolymer.

Figure 1. MOLECULAR WEIGHT AND SHEAR THINNING

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