Thermal Analysis & Rheology

RHEOLOGY SOLUTIONS

VISCOSITY MEASUREMENTS OF POLYMER FLUIDS

PROBLEM

It is sometimes difficult to obtain steady shear viscosity information for polymeric liquids or melts on rotational rheometers at shear rates which approach those representative of processing conditions. Samples, because of their viscoelastic character, tend to exude from the gap between the measuring fixtures and erroneous results are obtained.

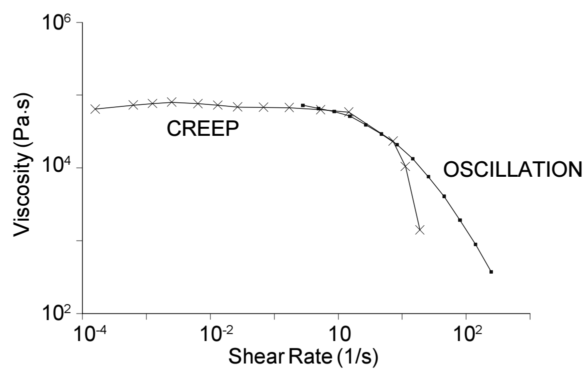
SOLUTION

Use can be made of the Cox-Merz (1) rule to obtain viscosity information for polymeric liquids over a wide shear rate range with a rotational rheometer. The Cox-Merz rule states that the steady shear viscosity, η, should be the same function of shear rate, γ, as the absolute value of the complex viscosity, $|\eta *|$, is of angular frequency expressed as radians/sec.

The steady shear viscosity, η, at low shear rates can be obtained from creep tests using a Controlled Stress Rheometer. Complex viscosity measurements can be made with the same unit using oscillatory tests. In these latter tests the frequency of applied stress is varied over a wide range while the strain which the sample experiences is kept at a low level. This procedure enables information to be obtained at high shear rates (corresponding to high frequencies) without loss of material from the gap between the measuring fixtures.

The results from creep and oscillatory tests on an ethylene-vinyl acetate copolymer, are shown in Figure 1. The region where the curves diverge coincides with sample exiting the gap during creep tests.

Figure 1. USE OF COX-MERZ RULE



(1) Cox, W.P., Merz, E.H., Correlation of dynamic and steady flow viscosities, J. Polym. Sci., 28, 619-622.Lab (US)

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