

Design of a Dynamic Mechanical Analyser for Rubber Compounds

H.M.R.C. Herath, I.J. Rodrigo, and V.S.C. Weragoda

Dynamic mechanical analysis (DMA) is a powerful technique for characterization of the viscoelastic properties of polymers such as thermoplastics, composites, thermosets and elastomers in the form of sheet specimens, films, fibers, coatings or adhesives. DMA instruments measure the modulus (stiffness) and damping (energy dissipation) properties of materials as they are deformed under dynamic stress. When a polymeric material is subjected to a cyclic sinusoidal stress within the viscoelastic region, the corresponding strain in the material would be out of phase due to the delayed response of the viscous portion of the material. This phase difference corresponds to the frequency of the force application and this is a unique characteristic of the polymer material. Amplitude of the strain curve and phase shift between stress and strain curves are usually identified as basic parameters.

In this design which is based on the ISO 6725 standard, forced vibration method was used and the vibrations are impacted by the inertia force of an eccentric rotating mass is used to generate sinusoidal force. Multi stress and multi frequency modes are operated by adjusting eccentricity and speed of rotating mass. The instrument also has facility to adjust the static force imparted on the specimen. Deformation of the material is detected by a displacement sensor. This design satisfied all requirements of the testing standard.