TITLE VISCOELASTIC BEHAVIOUR IN HYDROGENATED NITRILE RUBBER FOR INDUSTRIAL ROLL APPLICATIONS
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ABSTRACT Hydrogenated nitrile rubber (HNBR) was mixed with reinforcing fillers, namely, carbon black (CB), silica and organoclay. Cure, viscoelastic and mechanical properties of HNBR filled with various types and loadings of reinforcing fillers were investigated. Fourier transform (FT) rheometry was used to study the non-linear viscoelastic behaviour of filled rubber compounds. Filler loading appears to play a strong role on cure characteristics and non-linear viscoelastic response. The HNBR vulcanisate hardness of 80 Shore A was of interest in this work as a typical hardness used in industrial rollers, especially steel and paper mill rollers. Such hardness could be achieved by various reinforcing fillers. Among CB, silica and organoclay, the CB was found to be the most effective reinforcing filler, giving good mechanical properties. This was attributed to the superiority in magnitudes of filler dispersion and rubber-filler interaction as evidenced by the broadest linear viscoelastic (LVE) region. The reinforcement magnitude of N326/N990, N326/N774 and N550/N990 carbon black (CB) hybrid systems in HNBR vulcanisates was compared. The increase in loading portion of CB having larger surface area and/or greater structure in hybrid systems gives rise to the greater magnitudes of CB transient network formation and filler-rubber interaction. The relatively high structure of N550 leads to the high extents of bound rubber and crosslink density, yielding the comparable crosslink density, mechanical and viscoelastic properties of HNBR vulcanisates with N550/N990 and N326/N990 hybrid systems. Heat build-up (HBU) of HNBR filled with various CB loadings (i.e., 0 to 60 phr) and CB characteristics (i.e., N326, N550, N774 and N990) was determined using Gabometer 4000 flexometer equipped with high load cell of 4000 N. The HBU measured was then correlated with loss modulus measured from RPA 2000, giving the logarithmic relationship of: HBUG = 18.019ln(G”) - 54.138 with R2 of 0.9214. However, the relationship between HBU measured from RPA 2000 and Gabometer 4000 of HNBR vulcanisates filled various CB loadings and characteristics was relatively poor. In other words, the HBU measurement with RPA 2000 could not satisfactorily replace the standard HBU technique in the systems studied.