World Academy of Science, Engineering and Technology
International Journal of Materials and Textile Engineering
Vol:9, No:09, 2015

Energy Dissipation Characteristics of an Elastomer under Dynamic Condition: A Comprehensive Assessment Using High and Low Frequency Analyser

Authors : K. Anas, M. Selvakumar, Samson David, R. R. Babu, S. Chattopadhyay

Abstract : The dynamic deformation of a visco elastic material can cause heat generation. This heat generation is aspect energy dissipation. The present work investigates the contribution of various factors like; elastomer structure, cross link type and density, filler networking, reinforcement potential and temperature at energy dissipation mechanism. The influences of these elements are investigated using very high frequency analyzer (VHF) and dynamical mechanical analysis(DMA).VHF follows transmissibility and vibration isolation principle whereas DMA works on dynamical mechanical deformation principle. VHF analysis of different types of elastomers reveals that elastomer can act as a transmitter or damper of energy depending on the applied frequency ratio (ω/ωn). Dynamic modulus (G') of low damping rubbers like natural rubber does not varies rapidly with frequency but vice-versa for high damping rubber like butyl rubber (IIR). VHF analysis also depicts that polysulfidic linkages has high damping ratio (ζ) than mono sulfidic linkages due to its dissipative nature. At comparable cross link density, mono sulfidic linkages shows higher glass transition temperature (Tg) than poly sulfidic linkages. The intensity and location of loss modulus (G'') peak of different types of carbon black filled natural rubber compounds suggests that segmental relaxation at glass transition temperature (Tg) is seldom affected by filler particles, but the filler networks can influence the cross link density by absorbing the curatives. The filler network breaking and reformation during a dynamic strain is a thermally activated process. Thus, stronger aggregates are highly dissipative in nature. Measurements indicate that at lower temperature regimes polymeric chain friction is highly dissipative in nature.

Keywords : damping ratio, natural frequency, crosslinking density, segmental motion, surface activity, dissipative, polymeric chain friction

Conference Title : ICFPCMA 2015 : International Conference on Functional Polymers, Composites, Materials and Applications

Conference Location : Dubai, United Arab Emirates

Conference Dates : September 13-15, 2015