## ABSTRACT

Most of the elastomeric components are subjected to dynamic deformations during their service life. Thus, it is important to investigate how electrical and dynamic mechanical properties change when such composites are subjected to different modes of cyclic deformation-relaxation process. Also there are other factors such as temperature and pressure which have profound influence on the overall conductivity of rubber composites. In the present work, conductive composites were prepared using three common elastomers like SBR (Styrene butadiene rubber), CR (Polychloroprene rubber) and PDMS (Silicone rubber) filled with four different types of carbon black namely N770, N330, N220 and XC-72 at varying concentration. Effects of different cyclic deformations such as tensile, compressive and bend flexing on electrical conductivity have been investigated with an aim to understand practical implications in case of various pressure sensitive applications of conducting elastomeric composites. The electrical conductivity was measured against varying concentration of different carbon blacks to assess the percolation threshold of different composites. Due to spatial arrangement of conductive filler particles at certain critical concentration, their inter-particle gap becomes less than 10 Å, which electrons can hop. Thus some conductive networks are formed leading to abrupt increase in conductivity of polymer composites. This critical concentration is known as Percolation Threshold. The increase in conductivity well below and above percolation is relatively less compared to that around percolation. Variation of electrical conductivity and dynamic mechanical modulus due to flexing are found to be similar i.e. both characteristics show drop (SBR and CR composites) and rise (PDMS composites) in magnitude with increase in number of flex cycles. So, it may be concluded that carbon black aggregates forming filler networks attached to polymer chain are responsible for change in electrical conductivity and dynamic modulus during fatigue. When conducting composites are subjected to change in temperature, conductivity of system changes. This is mainly due to destruction of existing networks as well formation of some new conducting networks. The net change depends on the degree of formation or destruction of networks. It is interesting to see that conductivity does not follow the same path during heating-cooling cycle thereby causing electrical hysteresis. Further, suitability of these conductive composites for EMI shielding applications has also been investigated and it is found that composites can be efficiently used for EMI shielding purpose.

**Key Words:** Elastomeric composites; Carbon black; Conductive networks; Flex cycle; Negative coefficient of temperature (NCT).