

# Synthesis and Characterisation of Two-Roll Mill Processed Natural Rubber/Graphene Oxide Modified Silica Nanocomposites

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Tyre compounds consist of different additives such as antioxidants, fillers, plasticizing agents, vulcanising agents etc. in addition to natural rubber (NR). Two types of fillers; carbon black and silica, are used in rubber compounding. Carbon black is a powdered form of carbon which is completely miscible with organic rubbers. Nevertheless, silica ( $\text{SiO}_2$ ) is an inorganic compound which is not miscible with organic rubber. In addition, silica particles contain surface hydroxyl groups which tend to form hydrogen bonding leading to agglomerations.

Coupling agents are used to address these issues when silica is used as a filler in rubber compounding. Different coupling agents, such as silane, alkanolamides, poly (diallyldimethylammonium chloride) (PDDA) etc. are widely used for this purpose.

Performance of  $\text{SiO}_2$  and graphene, epoxidised NR and graphene and, NR and graphene oxide (GO), have been studied by previous researchers. This study was aimed to reduce aggregation of silica and to improve miscibility of silica in NR by modifying silica particles' surfaces with graphene oxide.

GO was synthesized by following a modified Hummers' procedure. Silica surface modification was done by simply grinding silica and GO together at a ratio of 100:5. Characterisation of modified silica was performed via FTIR spectroscopy SEM analysis. GO modified silica filled rubber compounds were made on a two-roll mill as per a standard formula. Rheological properties of the compounds were studied by MDR rheography and the mechanical properties such as, tensile strength, tear strength etc. of the vulcanisates were measured following appropriate standards. Overall results indicate that the modification technique used in the study has enhanced the dispersion of silica in rubber imparting some improvements in mechanical properties of NR vulcanisates.

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