

**EFFECT OF CARBON BLACK/SILICA HYBRID FILLED
NITRILE BUTADIENE RUBBER (NBR) ON CURE
CHARACTERISTICS AND MECHANICAL PROPERTIES**

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ABSTRACT

EFFECT OF CARBON BLACK/SILICA HYBRID FILLED NITRILE BUTADIENE RUBBER COMPOSITES ON CURE CHARACTERISTICS AND MECHANICAL PROPERTIES

This research investigates the effect of hybrid Carbon Black (CB) and Silica-filled Nitrile Butadiene Rubber (NBR) composites on cure and mechanical properties. Fourier Transform Infrared Spectroscopy (FTIR) was used to characterize the functional group and identify interactions between the NBR matrix and fillers. FTIR analysis revealed the presence of key functional groups and interactions within the NBR matrix, identifying five primary peaks in carbon black spectra (O-H, C=O, C=C, C-O) and three primary peaks in silica spectra (O-H, Si-O-Si, Si-OH). The findings revealed significant improvements in cure time and mechanical performance using hybrid fillers. The CB₄₀/Si₀ composite had the highest Ts₂ (11.76 minutes) and Tc₉₀ (25.51 minutes), while CB₄₀/Si₀ with 40 phr of carbon black content and no silica had much lower Ts₂ (5.21 minutes) and Tc₉₀ (15.23 minutes). Optimization of cure parameters resulted in shorter cure durations and higher vulcanization efficiency. The hybrid fillers also produced significant increases in tensile strength, elongation at break, and swelling percentage, demonstrating their synergistic benefits in NBR composites exceeding individual fillers.