

Development of High-Strength Natural Rubber Films: A Comparative Study of Glutaraldehyde-Cured Modified Natural Rubbers

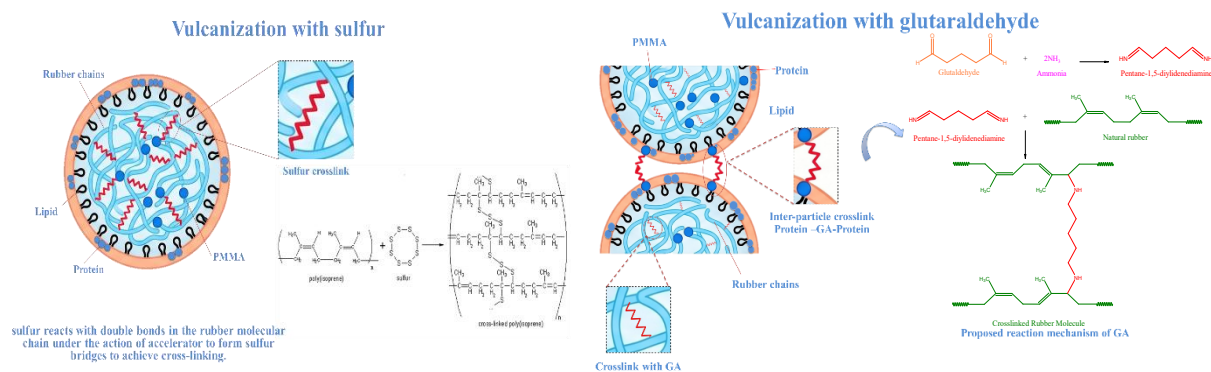
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This study investigates the crosslinking reactions of modified natural rubbers specifically poly(methyl methacrylate)-grafted natural rubber (NR-g-PMMA) and epoxidized natural rubber (ENR) using glutaraldehyde (GA) as a curing agent. The molecular structures of the modified rubbers were successfully confirmed using Attenuated Total Reflection Fourier Transform Infrared Spectroscopy (ATR-FTIR) and Proton Nuclear Magnetic Resonance (NMR) with 10 wt% grafting (NR-g-PMMA) and 50 mol% epoxidation in ENR. Incorporating GA into NR-g-PMMA resulted in the highest mechanical properties, achieving a tensile strength (TS) of 20 MPa, compared to unmodified NR (5 MPa) and ENR (1 MPa). These results indicate that GA actively reacts with the amino functional groups introduced in NR-g-PMMA. In contrast, the cured ENR exhibited the lowest mechanical properties due to its depleted protein content and reduced double bonds. This confirms that reinforcing rubber films with GA depends on reactions with both amino groups and natural proteins, alongside the remaining double bonds. Furthermore, when compared to a traditional sulfur-curing system which failed to form coherent films due to severe cracking the GA-cured NR-g-PMMA system successfully produced intact, high-performance films. This work demonstrates that using NR-g-PMMA cured with GA holds significant potential for applications requiring both high modulus and high elongation at break.

Scheme I



Research Keyword: Natural rubber, Methyl methacrylate, Epoxidation, Glutaraldehyde, Vulcanization.