

# REINFORCEMENT OF NATURAL RUBBER LATEX FILMS WITH FINE PARTICLE FILLERS

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## ABSTRACT

Reinforcement of natural rubber latex (NRL) is essential for NRL based thin film products manufacture. Silica is one of the most important reinforcing fillers used in dry rubber industry. However, the surface bound silanol groups that are polar and considerably chemically active, make silica less compatible with NRL.

In the present study, surface of precipitated silica (Ultrasil VN3) is modified with macromolecular coupling agents (MCAs) consisting of both hydrophilic and hydrophobic groups and the surface modified silica is incorporated into NRL in order to reinforce NRL films which is a novel concept introduced to confer interactions between silica-MCA complex and rubber particles.

The MCAs are synthesized in the laboratory by a solution polymerization technique using hydrophilic and hydrophobic monomers. Surface modification of precipitated silica particles with the MCAs is carried out in two reaction mediums; aqueous and non-aqueous, separately. Unmodified/ modified silica is added as aqueous dispersions at neutral pH to compounded and uncompounded NRL in four different levels of loadings from 5 phr to 20 phr in 5 increments. Thin latex films are cast from compounded/uncompounded NRL filled with unmodified and modified fillers.

Formation of H-bonds and/or covalent bonds between carboxylic groups of MCA and hydroxyl groups of silica is studied via FTIR spectroscopy and contribution of newly formed bonds in enhancing filler-rubber interactions is emphasized through mechanical, thermal and swelling properties. Microstructures of thin cross sections of filler added NRL obtained from SEM and optical microscope confirm the uniform dispersion of modified filler particles throughout the rubber matrix.

Tear strength and tensile strength are found to be increased by 50 % and 35 % respectively at 5-10 phr of filler loading of vulcanized films filled with filler modified by the most hydrophilic MCA compared with those of UM filler added vulcanizates.

**Keywords:** Reinforcement, natural rubber latex, silica, surface modification, macromolecular coupling agents

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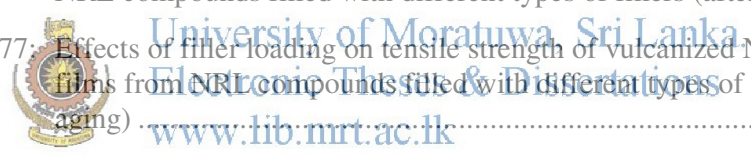
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