

**THE EFFECTS OF INCORPORATION OF
POLYETHYLENE GLYCOL ON PROPERTIES OF
SILICA-CARBON BLACK-FILLED RUBBER COMPOUND**

By

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ABSTRACT

The use of polyethylene glycol (PEG) to modify the surface of precipitated silica by means of physical adsorption was investigated. The effects of adding PEG on processing, cure and physical properties of a silica-carbon black-filled natural rubber truck tread compound were examined. For each series of investigation, two sets of experiments were conducted. Set 1 was to check the effects of both physical adsorption due to PEG and chemical modification due to a silane coupling agent, Si-69 on the surface of silica. Set 2 was to check the effects of physical adsorption due to PEG alone on the surface of silica. A carbon black-filled compound without silica, Si-69 and PEG was taken as the control sample.

Addition of PEG led to significant reduction in both cure time and scorch time and faster cure rate. This is due to the prevention of accelerator adsorption on the silica surface by PEG. The following physical properties were affected by the addition of PEG:

- Storage modulus of the compounds with Si-69 were reduced
- Cut growth resistance of compounds with Si-69 were reduced
- Tear strength of the compounds with Si-69 were improved
- Abrasion resistance of the compounds with or without Si-69 were slightly better.

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LIST OF ABBREVIATIONS

BR	Butadiene rubber
DEG	Diethylene glycol
DOTG	Di-o-tolylguanidine
DPG	Diphenyl guanidine
EB	Elongation at break
Hexa	Hexamethylene tetramine
HMMM	Hexamethoxy methyl melamine
ISAF	Intermediate super abrasion furnace
ISO	International Standardization of Organization
M300	Stress at 300% elongation
MH	Maximum torque
ML	Minimum torque
NBR	Acrylonitrile butadiene rubber
NR	Natural rubber
n_{phys}	Physically manifested crosslink
n_{chem}	Chemically discrete crosslink
ODR	Oscillating disc rheometer
PEG	Polyethylene glycol
pphr	Part per hundred rubber
SBR	Styrene butadiene rubber
Sg	Specific gravity
Si-69	Trade name for TESPT
$\tan \delta$	Tangent delta
TEA	Triethanolamine
TESPT	Bis[3-triethoxysilylpropyl-]tetrasulfane
TS	Tensile strength