Functionalized Liquid Butadiene Rubber with Di-sulfide Linkage for PCR Tire Tread Compounds

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Abstract

The automotive industry is shifting from internal combustion engine vehicles to electric vehicles due to the increasing need for sustainable, green mobility, where the power source does not emit pollutants. Therefore, the tire industry is focusing on improving fuel efficiency of tire by reducing rolling resistance and developing tires that meet the performance requirements of electric vehicles. In this study, we propose triethoxysilyl-terminated telechelic liquid butadiene rubber with di-sulfide linkages (Si69-LBR) as a new processing aid in the tire tread compound to enhance the tire performance.

The triethoxysilyl groups at both ends of Si69-LBR form covalent bonds with silanol groups on the silica surface, and the di-sulfide linkages in Si69-LBR additionally crosslink with the base rubber. Si69-LBR was synthesized via a "one-step" process using Si69, bis[3-(triethoxysilyl) propyl] tetrasulfide, as an iniferter (initiator—transfer agent—terminator). Compared to the compound applied with 40 phr processing oil (TDAE oil), the compound in which 10 phr of TDAE oil was replaced with Si69-LBR exhibited enhanced migration resistance, abrasion resistance, and fuel efficiency of 21%, 20%, and 7%. These results explain the advantages of the functionalization of LBR and the additional crosslinking resulting from sulfide bonds in Si69-LBR.

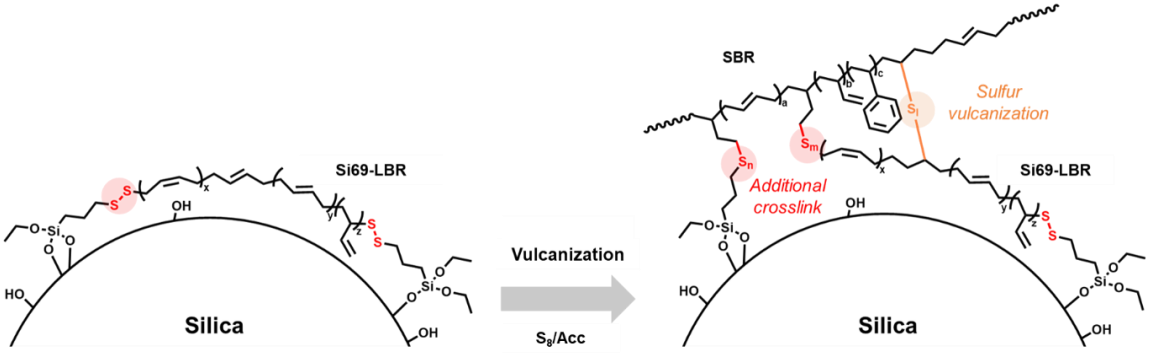

Figure 1. Additional crosslinking of Si69-LBR with base rubber during vulcanization

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References

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