

Joint hybridization of secondary fillers and secondary polymers towards improved silica-reinforced NR tire tread compounds

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Abstract

To improve the properties of silica truck tire tread compounds, especially abrasion resistance, the effect of vinyl-contents in Butadiene Rubber (BR) or Solution Styrene Butadiene Rubber (SSBR) as secondary polymers in silica-filled Natural Rubber (NR) compounds at a ratio of 80/20 phr, is investigated in the first part. By increasing the vinyl-content in BR in combination with NR, a better Payne effect, 300% modulus, reinforcement index, tan delta at -20°C and 0°C are obtained, whereas tensile strength, elongation at break and DIN abrasion resistance index decrease with increasing vinyl-content. Increasing vinyl-contents in SSBR show improvements in Payne effect, 300% modulus, tan delta at -20°C and 0°C and a little in DIN abrasion resistance index. The combination of secondary filler and polymer in silica-filled NR are covered in the second part of the present study. Silica/Carbon Black (CB)-filled NR/BR and NR/SSBR, resp. silica/OrganoClay (OC)-filled NR/BR and NR/SSBR show positive effects on the scorch time, optimum cure time, with slightly changed Payne effect, tensile properties, tan delta at -20°C and 0°C, and DIN abrasion resistance as compared to the compound with CB N134. The use of OC shows enhancement in Payne effect and tan delta at 60°C, indicative of a reduced filler-filler network and consequently lower rolling resistance of the tire tread compound compared to the compound without OC.