

Improvement of Rubber to Steel Adhesion in Press-on Solid Tyres by Varying the NR/BR Ratio in the NR/BR Composite Bonding Layer

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Abstract

Press-on solid tyres are typically made from a tread compound and a bonding layer as a composite on to the pretreated and adhesive (primer and cement) coated steel band. The so called intermediate bonding layer is a NR/BR composite. A significant problem in solid tyres is the loss of adhesion between steel and rubber with time. This limits the ultimate useful lifetime of the reinforcement and hence, of tires. This research was focused to investigate the improvement of the rubber to steel adhesion by varying the NR/BR ratio in the NR/BR composite bonding layer. In 1984 M.G. Huson et.al reported, even though NR and BR are differing little in either polarity or degree of unsaturation NR/BR blends have been shown to suffer uneven crosslink distributions in sulphur vulcanizates and effects the physico-mechanical properties of the NR/BR blends. D. Freitas (2003) showed in preparation of NR/BR rubber blends, the addition sequence with which the components of the formulation are mixed does have influence on the behavior of the final material. Fluctuation of the prices of NR and BR in the market also significantly affect to the cost of NR/BR composite.

In this study, NR/BR composites were prepared by varying the NR/BR ratio from 100/0, 90/10, 80/20, 70/30, 60/40, 50/50, 40/60, 30/70, 20/80, 10/90 and 0/100. Curing characteristics and the physico-mechanical properties including the adhesion value were measured in each prepared NR/BR composites. The best adhesion value obtained with the 50/50 NR/BR composite and it was 25.61 KN/m and that was in the excellent level according to the figures given for levels of adhesion for rubber to metal in ISO 813 peel test. The best tensile strength, hardness and the rebound resilience values also obtained from the 50/50 NR/BR composites and those values were 22.6 MPa, 63 IRHD and 55%. These properties together with cure characteristics and the ageing properties also were the best in the 50/50 NR/BR composite.

Adhesion values were higher than the adhesion value obtained from the currently utilizing NR/BR composite. The results further concluded that the so called properties including rubber to steel adhesion properties obtained from 50/50 NR/BR composite is better than the currently existing NR/BR composite which is with 70/30 NR/BR ratio.

Keywords: *Press-on solid tyres, Rubber to steel adhesion properties, NR/BR rubber blends*