

Title: Understanding the impact of rubber coupled to silica on tread compound properties

The present study sets out to evaluate the effect of rubber coupled to silica on the in-rubber properties of a model tread compound. Hydrophilic silica applied by the tire industry is incompatible with hydrocarbon rubber, such as styrene-butadiene rubber (SBR), therefore, it is often compounded with functionalized SBR, which can directly hydrophobize silica particles. Rubber coupled to silica particles was prepared by the reaction in solution of end-chain functionalized SBR with the silanols at the silica surface. It was found that silica, to a limited extent, was covered by rubber after the reaction. Then these particles were compounded as a filler in a model tread compound in the presence of various quantities of a covering silane and compared to pristine silica compounds containing the same quantities of the covering silane. Compounding the modified filler without covering silane resulted in strong filler-filler interactions that overshadowed the effect of the coupled rubber. When the remaining unreacted silica surface was further covered by a covering silane the filler-filler interactions were greatly reduced, demonstrating clearly the positive effect of the rubber coupled on in-rubber properties. The properties of the compounds obtained using the pristine and modified silica particles depend on the covering silane content in the matrix. For compound pairs with the same silane content, the modified silica compounds show less intensive marching vulcanization behavior, lower Payne effect and lower tensile strength than those in which pristine silica was used as a filler.