

Comparison of the reactivity of mercaptosilane and sulfursilane in a model study

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The use of mercaptosilanes catches on in silica-filled tire tread compounds. First studies have shown that they react in a different way with the polymer chain compared to the traditionally used sulfur silanes like Triethoxysilylpropyltetrasulfane (TESPT). In the present study, the reaction mechanisms of triethoxysilylpropylthiol (Si 263) with model olefins were studied in comparison to those of TESPT. Squalene and liquid polybutadiene were used as further model substances containing several double bonds and a higher molecular weight which should simulate the phenomena in the actual tire tread compound more precisely. In the liquid butadiene system, the addition reaction of Si 263 with vinyl and 1,4-double bonds was verified which was already observed in the model olefin study. The micro structure change by heating indicates that the addition reaction occurs preferably with the vinyl double bond. The cis / trans isomerization was confirmed in both silane systems, however, the degree of it in the Si 263 system was higher than that in the TESPT system. The cis double bond is involved in the crosslinking reaction for both silane systems. These different reaction mechanisms between mercaptosilanes and sulfursilanes with the polymer chain can explain the different mixing behavior based on the formation of different internal structures.