

This MSc assignment is done in cooperation with BOGE Rubber & Plastics

Rubber is a composite material with the main components being the elastomer and a filler. The most commonly used filler is carbon black; that's why most of the rubber products are actually black. However, there is a growing use of silica in elastomers as well, mainly for tires. By replacing carbon black by silica, the rolling resistance of a tire can be reduced, thus the fuel consumption of the vehicle will be lower. But silica can be used in much more elastomeric compounds to improve e.g. the crack resistance or other in-rubber properties. Currently the highest interest lies in the introduction of the silica as a new filler in compounds based on natural rubber, creating compounds without using oil as a main raw ingredients (synthetic polymers and carbon black are produced mainly from oil as starting material). One example for such an application is an engine mount.

Within this project, silica filled natural rubber mixtures will be prepared in the rubber lab (at UT or at the industry partner side) and investigated with the standard in-rubber testing equipment like cure behavior or stress/strain behaviour. Additionally, they will be characterized by a new device – the temperature scanning stress relaxation measurement (TSSR). This new device will be provided by the industry partner Boge.

### Objective

The goal of this assignment is to characterize silica-filled natural rubber compounds with a new technique, temperature scanning stress relaxation measurement (TSSR).

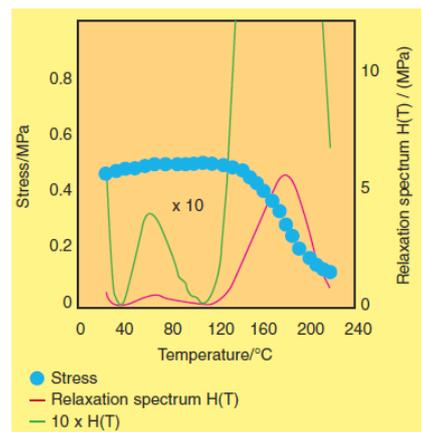
### Assignment

The graduate student will start with a literature search into elastomer-filler composites, with special attention to silica-silane systems. Within the practical study, elastomer composites are prepared with different types of silica. While doing this, the blending process has to be adjusted to these specific silica types. The silica will be compared according to their cure behaviour and their reinforcing effect. Besides, the dynamic properties such as loss and storage modulus and hysteresis will be measured. Additionally, the compounds will be characterized by TSSR. Most of this work will be done in the ETE labs.

### Report

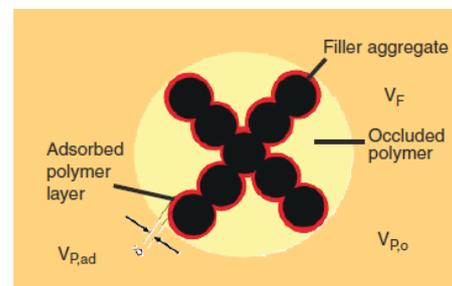
The graduation report comprises

- An overview of different filler systems for elastomers with special attention to silica based filler systems, the mixing technologies, and the related property profiles of the reinforced elastomers.
- The preparation of the elastomer composites.
- A correlation between the TSSR results and in-rubber properties of the silica compounds.



stress  $\sigma(T)$  and relaxation spectrum  $H(T)$  of an S-SBR sample filled with 30 phr silica (C1)

(N. Vennemann\_Rubberworld September 2012-18-23)



structure model of a filler aggregate in a rubber matrix

### Partners

This project will be done in cooperation with BOGE Rubber & Plastics (Damme, Germany).

### Contact

ETE: Anke Blume  
a.blume@utwente.nl  
BH208

