

ABSTRACT BOOK



THE 3rd
ASIA PACIFIC

APRC 2017

RUBBER

CONFERENCE



16th-17th November 2017

Prince of Songkla University,
Surat Thani Campus

Surat Thani, Thailand



USM

UNIVERSITI SAINS MALAYSIA



Rubber Compounding and Composites

Time-Temperature Superposition of Viscoelastic Mastercurves for Silica-Reinforced Tyre Tread Compounds: Constant-strain vs. Constant-stress Based

Jacques W.M. Noordermeer¹, Somayeh Maghami¹, Wilma K. Dierkes¹,
Tanja V. Tolpekina, Steven M. Schultz², Anke Blume¹

¹University of Twente, Elastomer Technology and Engineering, 7500AE Enschede, The Netherlands

²Apollo Tyres Global R&D B.V., Colosseum 2, 7521PT Enschede, The Netherlands

Abstract: An important aspect in the development of tyre compounds is the correlation between the dynamic mechanical properties of the rubber, measured on laboratory scale, and the actual tire performance. In order to predict wet traction of a tyre tread, the viscoelastic behavior of the rubber materials needs to be measured at high frequencies, in the kHz till MHz range. The deformations encountered by a skidding tyre tread are way outside the regime of linear viscoelasticity. Common dynamic mechanical equipment does not allow for measuring at such high deformations and frequencies. In order to overcome practical problems with measuring at such high frequencies and deformations, it is common to employ time-temperature superposition and measure at low frequencies and temperatures instead.

Another question is whether the dynamic mechanical measurements should be executed at constant strain over the frequency-temperature regime, or at constant-stress, where the latter is more representative for a tyre skidding on the road. The presentation addresses these questions based on a series of measurements with silica-reinforced passenger tyre treads, containing different amounts of silica. By combining various dynamic mechanical techniques, different measurement protocols can be compared: linear viscoelastic measurements, strain sweep measurements outside the linear regime (Payne effect), and measurements at constant stress for varied temperatures. The consequences for the horizontal and vertical shift factors in the time-temperature superposition are highlighted.
