APEM journal

Advances in Production Engineering & Management
Volume 8 | Number 2 | June 2013 | pp 126–133
http://dx.doi.org/10.14743/apem2013.2.160

ISSN 1854-6250
Journal home: apem-journal.org

Elongational viscosity of rubber compounds and improving corresponding models

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ABSTRACT

As good as the topic of elongational viscosity is covered by scientific work on thermoplastics, as little research has been done on rubber compounds. This paper focuses on the elongational properties of an SBR rubber compound using different measurement methods. First measurements were made on a Sentmanat Extensional Rheometer (SER). This method is limited to elongation rates up to 20 s^{-1}. Higher elongation rates (up to 300 s^{-1}) can be covered with a High Pressure Capillary Rheometer (HPCR), where Cogswell´s and Binding´s models were used. The simplifications of these methods were precisely depicted and their influence on the results was evaluated. For further improvement of Cogswell´s method a previously unreleased method by Obendrauf was applied using two different laws for the approximation of shear viscosity which is essential for the calculation of elongational viscosity. The calculated elongational viscosities could be ascertained using an orifice die for the refinement of the inlet pressure measurements. Finally, the elongational viscosity curves from the HPCR were compared with the SER-viscosity data and a good correlation could be found. This suggests that elongational viscosity ascertained from converging flow measurements is comparable to SER measurements, which would be of great practical use hence HPCRs are available at many laboratories.

ARTICLE INFO

Keywords:
Elongational viscosity
Extensional viscosity
Converging flow
Sentmanat extensional rheometer
Rubber compound

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