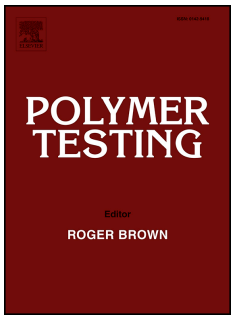
Accepted Manuscript



Tension testing of silicone rubber at high strain rates

Lingmei Guo, Yanan Lv, Zhifang Deng, Yang Wang, Xiang Zan

PII: S0142-9418(15)30309-3

DOI: 10.1016/j.polymertesting.2016.01.021

Reference: POTE 4581

To appear in: *Polymer Testing*

Received Date: 22 December 2015

Accepted Date: 26 January 2016

Please cite this article as: L. Guo, Y. Lv, Z. Deng, Y. Wang, X. Zan, Tension testing of silicone rubber at high strain rates, *Polymer Testing* (2016), doi: 10.1016/j.polymertesting.2016.01.021.

Test Equipment

Tension testing of silicone rubber at high strain rates

Lingmei Guo[a], Yanan Lv[a], Zhifang Deng[b], Yang Wang[a*], Xiang Zan[c]

a. CAS Key Laboratory of Mechanical Behavior and Design of Materials, Department of Modern Mechanics, University of Science and Technology of China, Hefei, Anhui, 230027, PR China

b. Institute of Structural Mechanics, China Academy of Engineering Physics, Mianyang, Sichuan, 621900, PR China

c. School of Materials Science and Engineering, Hefei University of Technology, Hefei 230009, PR China

*Corresponding author. *E-mail address*: yangwang@ustc.edu.cn

Abstract: The effect of strain rate on the tension behavior of filled silicone rubber was investigated over a wide range of strain rates. A non-contact optical measurement technique was used to accurately capture the deformation information of the tensile specimen under quasi-static loading conditions. Experimental methodology to investigate the tension response of rubber-like materials at high strain rates is presented. Dynamic tensile tests were performed using a split Hopkinson tension bar (SHTB) system. Specific specimen geometry and grip connection were designed to meet the requirements of one-dimensional experimental principle in the Hopkinson bar tests. The dynamic tensile stress-strain response of silicone rubber at high strain rates up to 1400 $s^{-1}$was obtained. Experiments reveal that the adopted experimental technique is reasonable for testing the tension response of soft materials at high strain rates, and the tensile behavior of silicone rubber is greatly dependent on the strain rate. The values of stiffness and nominal stress at a given elongation all increase with increased strain rate. According to the incompressible assumption, a phenomenological-based visco-hyperelastic constitutive model is proposed to describe the tensile behavior of silicone rubber over a wide range of strain rates.

Keywords: Silicone rubber; Tension behavior; Strain-rate dependence; Constitutive