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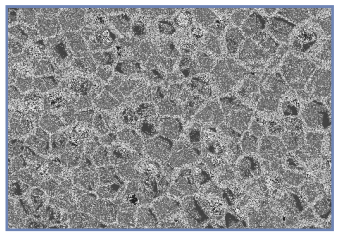
Case Study - Material Properties of Polymer Foams -

The Problem

Low density (≤50kg/m^3) foams are notoriously problematic to characterize. Standard material tests for properties such as tensile strength, Poisson's ratio etc cannot be performed on low density foams owing to the difficulty of attaching strain gauges, extensometers and the like.



A series of experiments have been developed that allow the material properties of low density foams to be determined accurately.

The Experiments

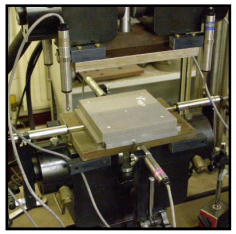
Temperature Dependent Tensile Testing[1]:

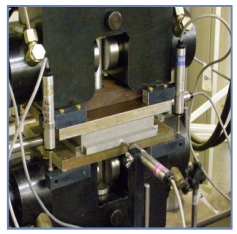
Tensile tests were carried out in accordance with ASTM D1623-03. Specimens were made by glueing a layer of foam to machined grips. A check was made to confirm uniform adhesive coverage. Samples were conditioned for two hours at the required temperature.

Tests were undertaken at a strain rate of 0.01s^{-1} and at temperatures ranging from 23°C to 120°C. Displacement was measured by an externally installed LDVT.

Compressive Poisson's Ratio:

In order to measure compressive strain, a foam sample was centered on a steel plate which had an LVDT placed at each corner. Lateral expansion was determined by spacers, with LVDT's attached, placed around the sample. Compressive load was applied to the sample. Two foams, having the same base polymer but of different density were tested.

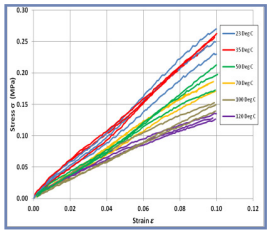


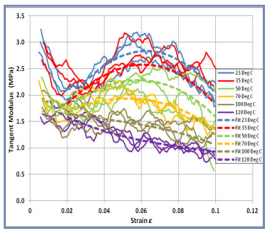


The Results

Temperature Dependent Tensile Testing[1]:

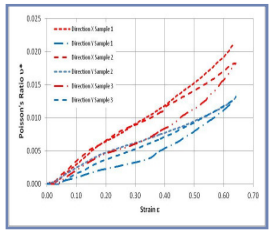
The experiments showed that for low density foam (30kg/m^3) the tangent modulus increases to a maximum value at 0.06 strain but becomes constant for strains greater than 0.1.

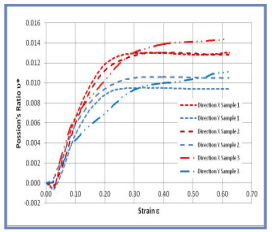




Compressive Poisson's Ratio:

Tests showed that for both foams Poisson's Ratio varied with strain with a maximum measured value of 0.02 at 0.6 compressive strain. For the foam of greater density (50kg/m^3), Poisson's Ratio remained constant for compressive strains greater than 0.2.





1. Based on research published in Key Engineering Materials Volumes 488-489

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