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Compression and hysteresis curves of nonlinear polyurethane foams under different densities, strain rates and different environmental conditions
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Abstract
Polyurethane (PU) closed cell foam samples with different densities were tested under loading and unloading compression tests at different temperatures and strain rates. Quasi-static compression tests were performed using the Lloyd LR5K Plus instrument at strain rates ranges from 0.033-0.267 s-1. Tests were conducted in a précised enclosure to control the dependency of PU foam cells on temperature and humidity. In order to have an accurate comparison in compression and hysteresis curves for all tests; all PU foam samples were selected intentionally from the same foam block but with different location densities. Furthermore, all foam samples were tested in the direction of foam rise (thickness). First, PU foam samples were compressed with a circular platen up to 70% strain at different strain rates and different temperatures. Then, the platen was raised completely from the foam samples. During the experiment; stress-strain responses were measured and plotted for loading and unloading curves to determine stored energy, dissipation energy and peak stresses were calculated at 70% strain. Results have shown that PU foam sample responses under compression testing gets softer at higher temperatures when conducted at a constant strain rates. At constant temperatures, PU foam samples get harder at higher slip rates. Finally, both stored and dissipation energies were found to be dependent heavily on foam density, ambient temperature and strain rate. Copyright © 2011 by ASME.

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