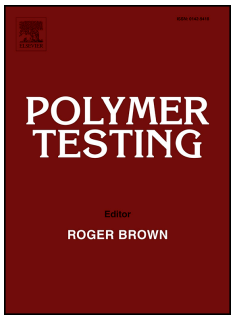

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Material Properties

Structure and Properties of Styrene-Butadiene Rubber (SBR) with Pyrolytic and Industrial Carbon Black

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ABSTRACT

To evaluate the performance of pyrolytic carbon black (pCB), we filled styrene-butadiene rubber (SBR) with pCB and N330 industrial carbon black (CB). We used two ratios of pCB and N330: 1/9 and 1/1. N330 was selected because its specific surface area was close to that of pCB. The overall CB content in the mixes was 0, 30, 45 and 60 part per hundred rubber (phr). We studied the effects of types and amounts of CB on the dispersion, cure behavior, dynamic mechanical thermal behavior, tensile mechanical and fracture mechanical properties of the filled rubbers. Dispersion of pCB was poorer than that of N330 CB. With respect to tensile mechanical properties – except tear strength – N330 outperformed pCB. The tear strength and fracture mechanics characteristics (J-integral at crack tip opening, and trouser tear strength) of SBR were higher with pCB than with N330. This can be attributed to the broader dispersion of pCB than N330. The combined use of N330 and pCB resulted in intermediate values, reflecting the actual N330/pCB ratio for all measured parameters. We wanted to correlate the mechanical performance with the apparent molecular weight between crosslinks (M_c), and found reasonable correlations for the Payne effect, tensile strength and critical J-integral. On the other hand, we only found a tendency for tear characteristics; this was ascribed to additional effects of (p)CB dispersion.

Keywords:

styrene-butadiene rubber; pyrolytic carbon black; mechanical properties; J-integral; structure-property relationship; apparent molecular weight between crosslinks