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Rheology and foaming behaviour of styrene–ethylene–butylene–styrene nanocomposites

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ABSTRACT:

The dependence of the foaming behaviour of a polymeric material on its material characteristics and foaming temperature gives rise to the research question that how the degree of dispersion/distribution of nanoparticles and the resulting viscosity changes affect the foaming behaviour and properties of nanocomposite foams. In the study reported here, styrene–ethylene–butylene– styrene was selected as a model polymer, because of its complex microstructure and its commercial importance. Styrene–ethylene–butylene–styrene nanocomposites, with different nanoclay loadings, were processed in a twin-screw extruder. The nanocomposite structure was correlated with the rheological properties to evaluate the batch-foaming performance of nanocomposite using carbon dioxide at different temperatures. At 35 °C, selective foaming of the elastomeric phase, hindered by the stiff polystyrene phase, resulted in foams with more than 74% shrinkage. At 80 °C, higher viscosities and moduli resulted in foams with higher volume expansion ratios. Increases in the degree of delamination of silicate layers in nanocomposites resulted in cell sizes up to 41% and 75% lower than that of neat polymer foams produced at 35 °C and 80 °C, respectively. Dynamic mechanical analysis results suggest heterogeneous nucleation and the presence of nanoclay in both phases. The study results show that the nanocomposite structure plays an important role in the production of thermoplastic elastomer foams of superior morphology and low shrinkage.