

Percolation Simulation of the Network Degradation During Ultrasonic Devulcanization

S. P. YUSHANOV, A. I. ISAYEV,* and V. YU. LEVIN

Institute of Polymer Engineering, University of Akron, Akron, Ohio, 44325-0301

SYNOPSIS

The percolation model of network degradation during rubber devulcanization is presented. The model is based on a random crosslink scission and molecular chain breakup. The obtained results indicate that the primary model parameter characterizing the network degradation is the ratio of the probabilities of backbone breakup to crosslink scission. The predicted dependences of the gel fraction of devulcanized rubber on crosslink density are in excellent agreement with experimental data for styrene-butadiene rubber and ground rubber tire. The estimated critical exponents indicate that the process of devulcanization for the vulcanizate without filler appears to belong to the universality class of standard 3D bond percolation while devulcanization for the vulcanizate with filler appears to belong to its own new universality class. © 1996 John Wiley & Sons, Inc.

Keywords: devulcanization • modeling • network • percolation • recycling • rubber • ultrasound