

# Ultrasonic Devulcanization of Rubber Vulcanizates.

## II. Simulation and Experiment

A. I. ISAYEV,\* S. P. YUSHANOV, and J. CHEN

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

### SYNOPSIS

The simulation results based on the devulcanization model presented in Part I of this study are described for devulcanization of SBR vulcanizates. The vulcanizates are conveyed by a single-screw extruder to a thin gap between a stationary die and a vibrating horn. Gapwise velocity, temperature, and shear-rate distributions along the die length are calculated. Predictions of the model for changes of various structural characteristics including gel fraction, fraction of various broken bonds, rate of their breakup, and void formation along die length are given. Devulcanization energy consumption and energy dissipated by ultrasonic waves are calculated. Comparison of these energies indicates that the devulcanization energy represents only a small fraction of the dissipated energy. The predicted results for gel fraction, crosslink density, die characteristics, and "mixing cup" temperature are compared with the experimental data. These predicted results are found to be only in qualitative agreement with experimental observations. The theoretical and experimental results indicate that the rubber is partially devulcanized and the devulcanization process is accompanied by some degradation of the macromolecular chains. © 1996 John Wiley & Sons, Inc.