ULTRASONIC DEVULCANIZATION OF SBR RUBBER: EXPERIMENTATION AND MODELING BASED ON CAVITATION AND PERCOLATION THEORIES

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ABSTRACT

Continuous ultrasonic devulcanization of styrene–butadiene rubber (SBR) is considered. Experiments are performed under various processing conditions. Two recipes of SBR with different amounts of polysulfidic linkages are utilized. Gel fraction and crosslink density of devulcanized rubbers are measured and a unique relationship between them is established. This relationship is found to be in agreement with the 3D percolation theory. Die characteristics with and without imposition of ultrasonic waves are determined. A modification of acoustic cavitation and flow modeling of ultrasonic devulcanization of SBR is proposed using a concept of effective viscosity characterizing the flow of vulcanized particles before devulcanization combined with a shear rate, temperature, and gel fraction dependent viscosity of devulcanized rubber. Velocity, shear rate, pressure, and temperature field along with gel fraction, crosslink density, and number of bonds broken are simulated. Predicted data on gel fraction, crosslink density, amount of poly-, di- and monosulfidic bonds, and pressure are found to be in qualitative agreement with experimental data.