

NOVEL ULTRASONIC TECHNOLOGY FOR DEVULCANIZATION OF WASTE RUBBERS

A. I. ISAYEV, J. CHEN, AND A. TUKACHINSKY

INSTITUTE OF POLYMER ENGINEERING, THE UNIVERSITY OF AKRON, AKRON, OH 44325-0301

ABSTRACT

A novel patented process and several reactors have been developed for devulcanization of waste rubbers. The technology is based on the use of the high power ultrasonics. The ultrasonic waves of certain levels in the presence of pressure and heat rapidly break up the three-dimensional network in crosslinked rubbers. The devulcanized rubber can be reprocessed, shaped and revulcanized in much the same way as a virgin rubber. The first laboratory reactor has been scaled up to pilot-plant level by the National Feedscrew and Machining, Inc.

Various devulcanization experiments were carried out with model styrene-butadiene rubber (SBR) and with ground rubber tire (GRT). Curing behavior, rheological properties, and structural characteristics of rubbers devulcanized at various processing conditions were studied, as well as mechanical properties of revulcanized rubber samples. A possible mechanism of the devulcanization is discussed. The performed measurements indicate that the rubbers are partially devulcanized, and the devulcanization process is accompanied by certain degradation of the macromolecular chains. In spite of these observations, the processing conditions are identified at which the retention of the mechanical properties is found to be good. A further work is in progress to find the optimal conditions of devulcanization and to improve the selectivity of the process towards breaking up the chemical network only.