

Watcharapong Chookaew 2014: An Investigation into Weldline Strength of Rubber Molded Parts. Doctor of Engineering (Mechanical Engineering), Major Field: Mechanical Engineering, Department of Mechanical Engineering. Thesis Advisor: Mr. Jirachai Mingbunjerdasuk, Ph.D. 147 pages.

This work aims to investigate the effects of filler types and contents, vulcanizing systems, and processing parameters on the tensile strength and fatigue life of weldline containing natural rubber (NR) parts. From the experimental results, it can be seen that the increasing amount of CaCO_3 did not affect the tensile strength of NR. However, the differences in maximum tensile strength and fatigue life between weldline and non-weldline NR specimens became larger with the increase of SiO_2 and CB concentration. In the case of curing systems, the tensile strength of weldline containing NR vulcanized by CV system was found to be lower than that of EV system, while the fatigue life of NR vulcanizates using CV system was higher than of EV system. The results also suggested that the tensile strength and fatigue life of NR containing weldline significantly increased with the increase of mold temperature and clamping pressure.

The mathematical models for the prediction of weldline strength and weldline position have been developed. A satisfying agreement between the analytical and experimental results indicated that the kinetic model for vulcanization, regression models and neural network model can be employed as a valuable tool for the prediction of weldline strength of rubber molded parts and also the occurrence of weldlines during the compression molding process. In addition, the neural network model was utilized for construction the strain-energy-density function in order to simulate the stress-strain behavior of rubber parts. The proposed model was verified to the experiments and those of general constitutive models i.e. Neo-Hookean, Mooney-Rivlin, and Ogden models. From the comparison results, a good agreement between developed model and existing experimental data was found, especially at very low strain and at very high strain.

Student's signature

Thesis Advisor's signature