

Yanichsa Sukniyom 2011: An Investigation into the Rheological Behavior of Rubber Compound during the Flow in Micro-channel. Master of Engineering (Materials Engineering), Major Field: Materials Engineering, Department of Materials Engineering. Thesis Advisor: Mr. Somjate Patcharaphun, Dr.-Ing. 132 pages.

In this work, the rate-controlled capillary rheometer was specially designed and constructed in order to primarily investigate the influences of shear rate, test temperature, vulcanization system, filler type and content on the rheological properties of natural rubber compounds. The rheological properties of rubber compounds were characterized with respect to the apparent viscosity and die swell ratio. The effects of flow channel (i.e. type, size, and length) were main interest. The measured results indicated that the apparent viscosity of rubber compound tended to decrease with increasing shear rate and test temperature. It was also found that the apparent viscosity increased, while the die swell ratio of rubber compound tended to decrease with increasing amount of filler added. From the rheological results obtained by using the micro-channel, for the non-sulfur system, it should be noted that the viscosity and die swell ratio of rubber compound significantly decreased as compared to those obtained from conventional and efficient vulcanizing systems. This was due to the occurrences of premature crosslink at the skin layer and the slippage of rubber compound during the flow in micro-channel. The apparent viscosity and swelling ratio of rubber compound by using slit die was higher than that of circular die. Furthermore, the super-extrusion phenomenon was found in this work which was probably associated with the occurrences of premature crosslink at the skin layer, type of crosslink, slippage at the die wall, and filler-rubber matrix interaction.

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