Abstract

This paper presents an application of microwave heating for pre-heating of natural rubber compound with various sulphur contents using a rectangular wave guide (Mode: TE_{10}). It operates at frequency of 2.45 GHz in which the power can vary from 0 to 1,500 W. The experimental and numerical studies were conducted in the present work.

In the experimental part, microwave was applied to heating the natural rubber compound for the purpose of pre-heating before vulcanisation process. The influence of power input, sample thickness, and component of natural rubber compound were examined. Results were discussed in views of the thermal properties and chemical structures of natural rubber compound after being pre-heated by microwave. It was found the result that, firstly, microwave heating can be applied to pre-heating natural rubber compound before vulcanisation process. Secondly, microwave heating was very useful that it is able to pre-heat natural rubber compound that has thickness greater than 1 cm. Thirdly, cross-linking in natural rubber compound may occur after pre-heating by microwave heating though FTIR measurement. Finally, there were a few effects of sulphur content on temperature profiles after applying microwave per-heating in the natural rubber compound. Moreover, natural rubber compound without carbon black showed a lower loss tangent coefficient compared with natural rubber compound filled with carbon black. This is due to the difference in dielectric loss factor.

The main in purposes of numerical work is to study microwave power absorbed and temperature propagation within natural rubber compound (compared with the experimental) under microwave pre-heating. The influence of power input, sample thickness, and microwave frequency were examined. The results were discussed in views of the thermal properties compared with the experimental results by using numerical scheme that includes Maxwell's equation and heat transport equation. The numerical results from this study are able to explain behavior of temperature propagation as well as the experimental results.

This preliminary result along with the fundamental study of microwave to pre-heating natural rubber compound is considered a useful information that can be applied to rubber processing in industries.