World Academy of Science, Engineering and Technology
International Journal of Mechanical and Industrial Engineering
Vol:9, No:03, 2015

Numerical and Experimental Analysis of Temperature Distribution and Electric Field in a Natural Rubber Glove during Microwave Heating

Authors : U. Narumitbowonkul, P. Keangin, P. Rattanadecho

Abstract : Both numerical and experimental investigation of the temperature distribution and electric field in a natural rubber glove (NRG) during microwave heating are studied. A three-dimensional model of NRG and microwave oven are considered in this work. The influences of position, heating time and rotation angle of NRG on temperature distribution and electric field are presented in details. The coupled equations of electromagnetic wave propagation and heat transfer are solved using the finite element method (FEM). The numerical model is validated with an experimental study at a frequency of 2.45 GHz. The results show that the numerical results closely match the experimental results. Furthermore, it is found that the temperature distribution and electric field increases with increasing heating time. The hot spot zone appears in NRG at the tip of middle finger while the maximum temperature occurs in case of rotation angle of NRG = 60 degree. This investigation provides the essential aspects for a fundamental understanding of heat transport of NRG using microwave energy in industry.

Keywords : electric field, finite element method, microwave energy, natural rubber glove
Conference Title : ICMETA 2015 : International Conference on Mechanical Engineering : Theory and Application
Conference Location : Singapore, Singapore
Conference Dates : March 29-30, 2015