STUDY OF THERMAL CONDUCTIVITY OF POLYMERS AND A POLYMER COMPOSITE BASED ON Al_2O_3 FILLER

H.S. Alahakoon

Postgraduate Institute of Science, University of Peradeniya, Peradeniya, Sri Lanka.
Department of Physics, University of Peradeniya, Peradeniya, Sri Lanka.

A method to measure the thermal conductivity of the thermally insulating materials was investigated using a modified technique based on differential scanning calorimeter (DSC).

In this study, the obtained values for the thermal conductivity of polymer samples were shown in well agreement with the reference values. The measured average thermal conductivities are 0.21, 0.10, 0.20, 0.27, 0.40 W m^{-1} K^{-1} for poly(ethylene), poly(vinyl chloride), teflon, nylon and ebonite respectively.

This method was further extended to find the filler effect on the thermal and electrical properties of a polymer composite by choosing poly(ethylene oxide) (PEO) as the polymer host and alumina (Al_2O_3) as the ceramic filler. The value of thermal conductivity of PEO increases with the increase of Al_2O_3 content in the sample. There is an 80% enhancement in value of thermal conductivity of sample with 30 wt% of Al_2O_3, with respect to the pure PEO samples. However, it can be seen that there is no significant enhancement in electrical conductivity with the increase of filler percentage. That implies there is no effect on the enhancement of the electrical conductivity of polymer by adding a ceramic filler. So, polymer-ceramic composites are suitable candidates for the current industrial necessities which are interest in electrically insulating but thermally conductive materials.