Abstract

Traditionally, for applications that require heat transfer (e.g. heat exchangers), metals have been the go-to material for manufacturers because of their high thermal as well as structural properties. However, metals have some notable drawbacks. They are not corrosion-resistant, offer no freedom of design, have a high cost of production, and sourcing the material itself. Even though polymers on their own don’t show great prospects in the field of thermal applications, their composites perform better than their counterparts. Nanofillers, when added to a polymer matrix not only increase their structural strength but also their thermal performance. This work aims to tackle two of those problems by using the additive manufacturing method, stereolithography to solve the problem of design freedom, and the use of polymer nanocomposite material for corrosion-resistance and increase their overall thermal performance. In this work, four different concentrations of polymer composite materials were studied: 0.25 wt%, 0.5 wt%, and 1 wt% for their thermal conductivity. The samples were prepared by magnetically stirring them for a period of 10 to 36 hours depending on their concentrations and then sonicating in an ice bath further for a period of 3 to 12 hours. These samples were then tested for their thermal conductivities using a Hot Disk TPS2500S. Scanning Electron Microscope (SEM) to study the dispersion of the nanoparticles in the matrix. Different theoretical models were studied and used to compare experimental data to the predicted values of effective thermal conductivity. An increase of 7.9% in thermal conductivity of the composite material was recorded for just 1 wt% addition of multi-walled carbon nanotubes (MWCNTs).