ELECTRICAL CONDUCTIVITY OF STYCAST 1266 EPOXY/ GRAPHENE COMPOSITES

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1 Introduction

Nano-composite materials based on carbon nano-filler show novel properties in nano and macro scale. This kind of material is expected to open new opportunities for energy storage, biomedical, nano-electronics and nano-composite materials

One of the important applications of nanomaterial still continues to be serious concern for modern science and technology. That is electromagnetic interference (EMI) shielding of radio frequency radiation. EMI shielding is used widely in commercial, scientific and military electronic devices and communication instruments. In this field nano-composites excel metal based EMI shielding materials in terms of lightweight, corrosion resistant, flexible and processing methods. As a carbon nano-filler, graphene draws great attention due to its unique electrical properties and mechanical properties.

Up to now graphene/graphite based nano-composites using epoxy as a matrix has the lowest percolation threshold ~ 0.52 (vol%) for electrical conduction.[1] There is still lack of attention to epoxy/graphene nano-composite compared with other kinds of graphene based polymer nano-composite.

This study focuses on electrical conductivity as well as EMI shielding characteristics of epoxy graphene composite.

2 Experiments

2.1 Fabrication of epoxy graphene composite

The materials to produce nano-composite in this research are commercial epoxy Stycast 1266 and commercial graphene nanoplatelets.

A certain amount of graphene was dispersed in ethanol. The mixture is sonicated at 60 kHz for at least three hours to separate graphene layers completely. Then this mixture was injected into the part A of Stycast 1266. After stirring process was carried out, the mixture of the part A and dispersed graphene was kept at room temperature for at least 12 hours so that ethanol was removed completely. Then part B of Stycast 1266 was added into the mixture. The final mixture was placed in a vacuum desiccator to promote a good dispersion of the graphene layer.[2]

2.2 Measurements of electrical conductivity

All the samples were prepared as slabs of desired size and the surfaces of the slabs were polished. Gold electrodes were made on the faces of the sample by evaporation. Two kinds of electrical property were measured: DC electric conductivity was measure by using Keithley 220 programmable source. Dielectric measurements were conducted using a HP 4284A LCR meter.

3 Results and Discussion

Nano-composites of graphene and Stycast 1266 epoxy with mass fraction in range of 0.1 wt% ~ 15wt% are produced. DC electrical conductivity measurements show a remarkably low percolation threshold. Dielectric measurements reveal that dielectric constant of this composite depends on frequency strongly.

4 Conclusion

The graphene/epoxy composites with various concentration in the range of 0.1 wt% ~ 15wt% were

fabricated and its electrical properties were investigated for the EMI shield application. Due to lightweight and low concentration of graphene, graphene/epoxy nano-composites can be utilized commercially as a potential material for electro-magnetic radiation shielding.

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