EFFECT OF MICROWAVE HYDROTHERMAL TEMPERATURE ON THE SYNTHESIS AND MAGNETIC PROPERTIES OF $ZnFe_2O_4$/rGO NANOCOMPOSITE MATERIALS

Kun-Yauh Shih [a], En-Rui Wang [a], and Chun-Rong Lin[b]

[a]Department of Applied Chemistry, National Pingtung University, Pingtung, Taiwan
[b] Department of Applied Physics, National Pingtung University, Pingtung, Taiwan

$ZnFe_2O_4$/rGO composite materials are obtained by attaching $ZnFe_2O_4$ nano-magnetic particles to the surface of non-magnetic reduced graphene oxide (rGO). Therefore, $ZnFe_2O_4$/rGO is theoretically a magnetic composite material. In this study, we prepared graphene oxide (GO) using a modified Hummer's method and synthesized $ZnFe_2O_4$/rGO nanocomposite materials by microwave hydrothermal synthesis at different temperature conditions. The materials were identified by X-ray diffraction spectroscopy (XRD), Raman spectroscopy (Raman), transmission electron microscopy (TEM), and thermogravimetric analysis (TGA). The magnetic properties of the samples synthesized under different temperatures were compared further by means of a vibrating sample magnetometer (VSM).

The results showed that the XRD measurements of the samples synthesized under different temperature conditions showed significant peaks of winding, corresponding to the (220), (311), (400), (422), (511), and (440) crystal planes of cubic spinel $ZnFe_2O_4$ (JCPDS 22-1012), which confirmed that $ZnFe_2O_4$ had been successfully compounded on rGO. The Raman spectra show that the sample has obvious peaks near 1354 cm^{-1} and 1606 cm^{-1}, which are the D band and G band respectively, confirming the presence of graphene in the sample. The TEM image shows that the particle size of the composite material is less than 20 nm, which confirms that the synthesized material is of nanoscale. The proportional relationship between $ZnFe_2O_4$ and rGO was determined by TGA measurements. VSM measurements at room temperature confirmed the magnetic properties of the synthesized $ZnFe_2O_4$/rGO at different temperatures. Moreover, it is clear from the experimental results that the saturation magnetization of the composite rGO shows a significant decrease compared to that of pure $ZnFe_2O_4$. The saturation magnetization of the composite materials synthesized at different temperatures is closely related to the degree of the composite.

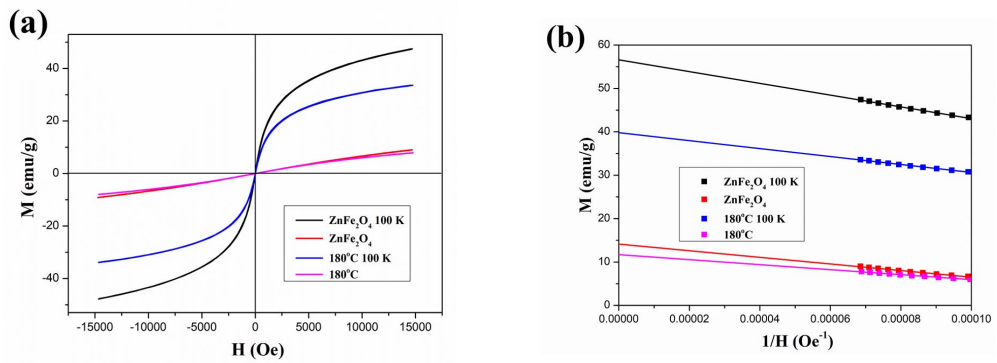

Figure 1 VSM curves (a) and the law of approach to saturation graph (b) for $ZnFe_2O_4$/rGO at various synthesis temperatures