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Polydimethylsiloxane resin nanocomposite coating with alternating multilayer structure for corrosion protection performance

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FTIR is always used to detect material chemical groups. It can be discovered from Fig. 1S that there is an intense and wide absorption peak at near 3434 cm^{-1} which is the stretching vibration of O-H. The absorption peak at near 1629cm^{-1} is due to the stretching vibration of C-C aromatic skeleton. The one near 1402cm^{-1} is created by the flexural vibration of C-O. So graphene oxide contains different active oxygen-containing functional group such as-OH, -COOH and epoxy groups. The RGO shows the similar absorption peaks near 3434 cm^{-1}, 1634 cm^{-1} and 1402 cm^{-1}, but they are highly weakened due to the decrease of active oxygen-containing functional groups. That is to say that it is an efficient way to reduce graphene oxide by hydrazine hydrate method.

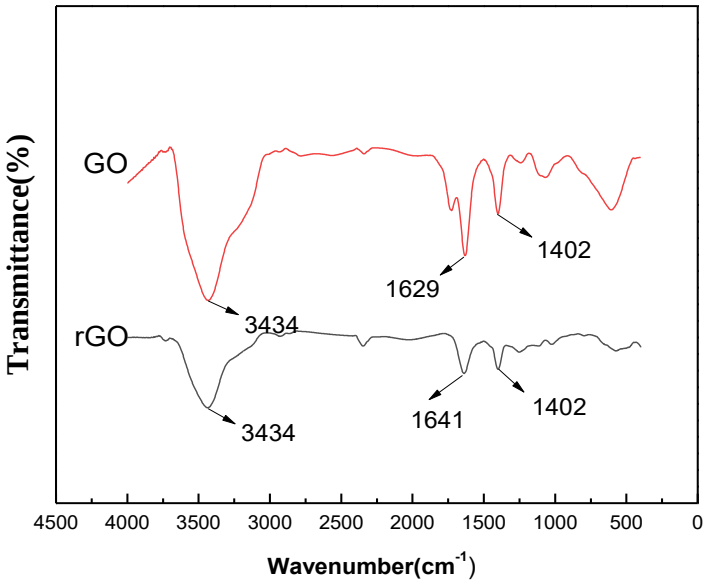

Fig. 1S the FTIR of of GO and RGO

Raman spectrum is one of the most efficient way to demonstrate carbon material's structure composition. There are 3 characteristic peaks of graphene oxide and graphene in Raman spectrum (Fig. 2S), corresponding to D, G and 2D peaks. D peak appears around 1350cm^{-1} which is caused by carbon atom's breathing vibration in sp^2 hybridization, representing carbon lattice's drawback and degree of disorder. G peak appears around 1600cm^{-1} and represents the stretching vibration of carbon atom in sp^2 hybridization. The intensity of D peak ration is normally used to evaluate the regularity of carbon materials. The smaller the ratio is, the higher the regularity is, the better the

reduction is. The 2D peak appears around 2680cm^{-1} caused by double reverse momentum which is related to the layers of graphene. The ratio of ID/IG for GO and RGO are 0.8 and 1.1, respectively. The reason might be that the defects increase coming from the decrease of graphene size during the sp^3 transfer to sp^2 hybridization in the reduction process of RGO. The RGO ratio of G/2D is about 5 (Fig. 2S) which means the sample is multi-layer RGO.

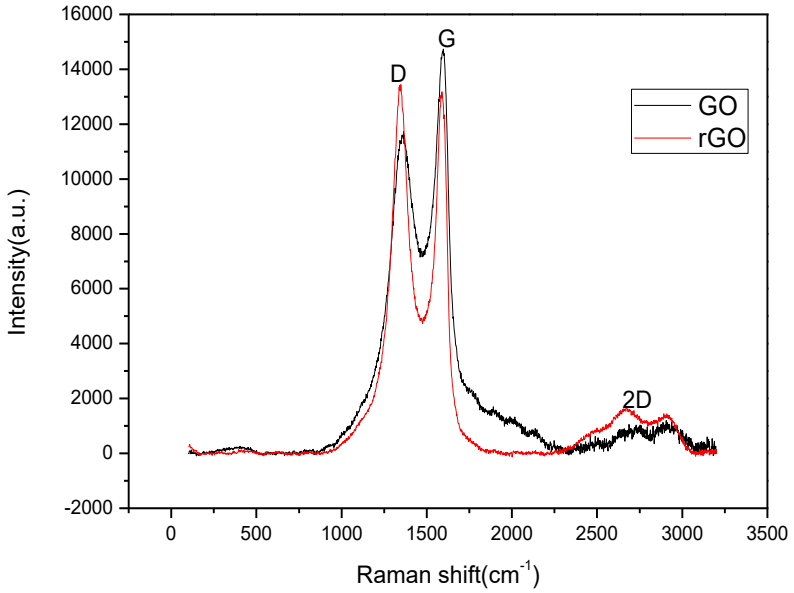

Fig. 2S Raman spectrogram of GO and RGO

Fig. 3S is the XRD curves of GO and RGO. The GO appears sharp peak (001) at 10 ° due to GO contains a lot of defects and oxygen groups. In addition, the GO and RGO have the weak peak near 26 °, which is the diffraction peak of graphite surface (002). The disappearance of peak at 10 ° means the eliminate of oxygen-containing groups and the reduction of GO.The second peak around 45° in the XRD results of rGO in Fig. S3 is the peak of Graphite,these phnomenon indicate that there is still graphite in the RGO.

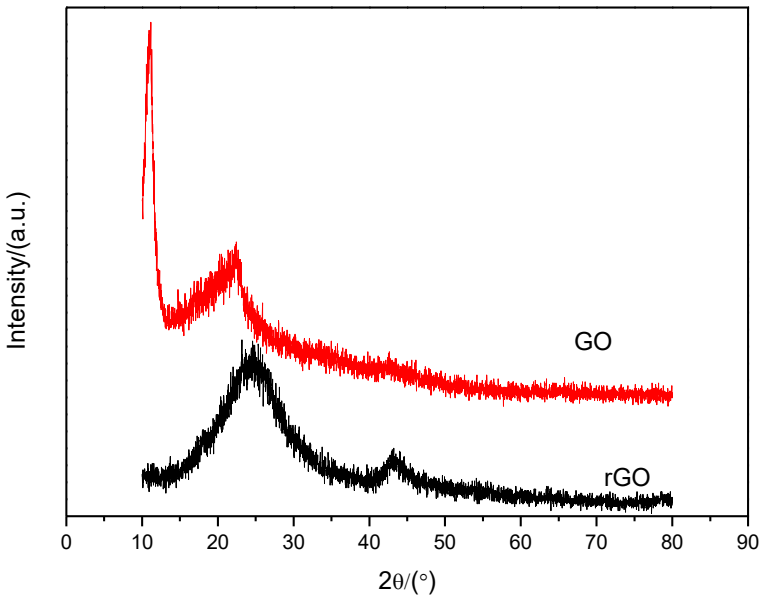

Fig. 3S XRD spectrum of GO and RGO