One-pot and scalable synthesis of fluorinated graphene for hydrophobic modification

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Abstract

Functionalized graphene (FG) and graphene oxide have great potential for industrial applications such as corrosion protection, surface modification and so on. Recently, the fluorinated graphene have been synthesized by various approaches; however, most of processes using toxic chemicals with complex steps, which are not practical for applications. Therefore, development of an easy and mass production synthesizing process is necessary. Here, for the first time, we report a novel hydrothermal method for fabricating FG through frequently used Nafion as reagents. Graphene oxide solution mixed with various concentrations (20-70%) of Nafion as additives were processed in autoclave (200 °C). The resultant FG is well dispersed in N-Methyl-2-pyrrolidone (NMP). The XPS spectrum analysis exhibits C-F related binding states, such as C-CF, CF2, and CF3, indicating the (Figure 1). To study the surface chemistry of as-prepared FG, the controllable coating via layer-by-layer process were developed to obtain uniform FG film (Figure 2 (a)). The water contact angle measurement shows that surface could be adjusted to be hydrophobic, where the highest contact angle of 112.3° was achieved (60% of Nafion). Other applications based on this materials, including anticorrosion film (FG/PU/epoxy) and heat transfer efficient (boiling and drop condensation) investigation will also been conducted. This work proposed an one-pot and simple process for preparing FG in a scalable way, which is potential for applications on green-energy and sustainable environment in the future.

References

[1] A. Mathkar et al., Part. Part. Syst. Charact., 30 (2013) 266-272
[2] W. Feng et al., Adv. Sci., 3 (2016) 1500413

Figures

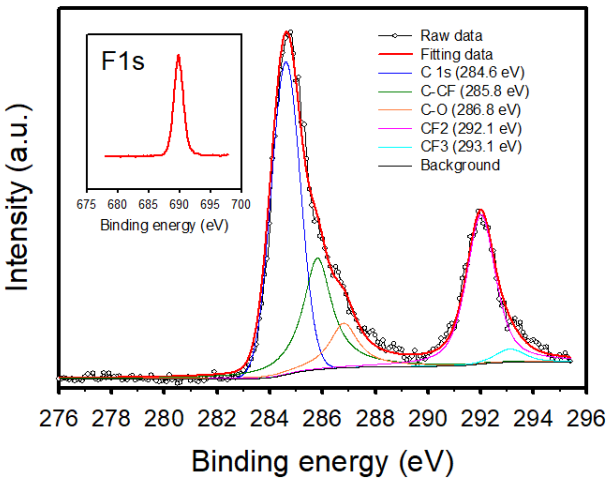

Figure 1: XPS analysis on FG at 60% Nafion.

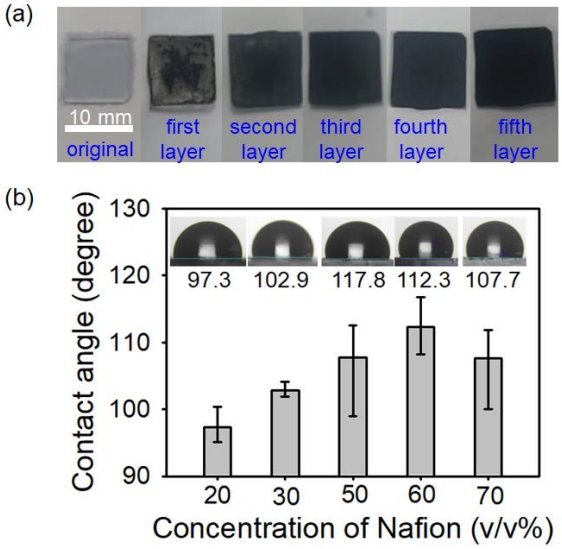

Figure 2: (a) Layer-by-layer coating of FG on glass substrate (b) Contact angle measurement of FGO by various concentrations of Nafion reagents.