A Green Approach to the Chemical Modification of Graphene

Wen-Ren Wang, Zhi-Jia Zhang, Che-Yun Hisao, Yao Pin-Chuan
E-mail: pcyao@mail.dyu.edu.tw

ABSTRACT

Graphene has been a subject of intensive research due to its perfect two-dimensional structure and unique electronic, mechanical and optical properties [1]. Despite the wide range of possible applications, there are still many challenges for graphene to reach its full potential. For example, the surface properties of graphene sheets must be altered through further functionalization to obtain stable dispersions in solvents [2]. Various kinds of materials can be functionalized on graphene to induce more functionality. In general, there are three kinds of functionalization methods, either by molecules, nano-objects or polymers [3]. In the present study, a green method is reported to effectively modify the structures of reduced graphene oxides with organic acids and bases under milder hydrothermal conditions. In a Teflon-lined autoclave containing 12ml of 0.1M oxalic acid and 0.6g graphene (Allightec Co. Ltd, 3~5 layers) was heated in a 100°C oil bath for 12h. After vacuum filtration through a 0.45 µm Millipore membrane filter and washing several times with DI-water and were air-dry in a desiccator for 1 day. The samples were abbreviated as P01, P05 and P10 for those chemical treated with 0.1M, 0.5M and 1.0M oxalic acid, respectively. Similarly, capital C and S stands for citric acid and succinic acid, sequentially, whereas P1C10 represents mixture of 0.1M oxalic acid with 1.0M citric acid.

The morphology of the samples was studied by SEM which shows little difference between all chemical treated graphene derivates. It is noteworthy that for pristine graphene in Fig.1(a), the stack-layers-like structure is prominent. Accordingly, the hydrothermal treatment facilitates the segregation of graphene layers [4]. XRD patterns in Fig.2(a) indicates that all samples endow with the crystalline structure of graphite which could be attributed to the poor dispersion of graphene layer during analysis. The chemical treatment involves the removal/rearrangement of functional gr...

Keywords: Graphene, chemical modification, Raman, Oxalic acid

REFERENCES

References


[6] A. Nekahi, P.H. Marashi, D. Haghshenas, Trans...