

A facile fabrication of carbon fiber supported Fe-doped CoMnP derived from metal-organic framework structure for a high-performance electrochemical energy storage application

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1. Introduction

The development of new nanomaterials based energy storage device with excellent analytical performance in terms of high energy and power density, simple fabrication, low cost and light-weight has been tough job [1]. Among different types of energy storage devices, electrochemical supercapacitors are more attractive due to their special properties including simple energy storage mechanism, excellent rate capability, good power density, long cycle life, quick charge-discharge rate and so on. In this work, we have designed Fe-doped CoMnP over carbon fiber used as substrate. Initially, CoMn MOF was developed over the carbon fiber (CoMn/CF) by hydrothermal method and then Fe with different ratio was doped over the pre-deposited CoMn MOF/CF. Finally, the Fe-doped CoMn-MOF/CF was undergoing the phosphidation to form Fe-doped CoMnP.

2. Manuscript Format

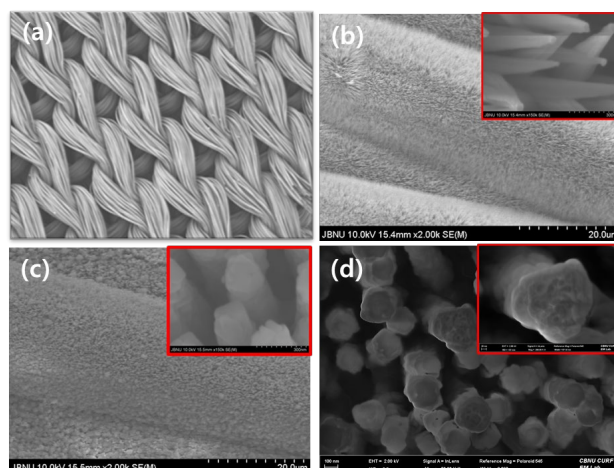
2.1 Materials

Cobalt nitrate, 2-methyl imidazole and manganese nitrate were procured from Sigma-Aldrich. All other chemical were of analytical grade and used without further purification.

3. Results and Discussion

The as-fabricated CoMnP/CC was characterized by FE-SEM, EDX spectrum, EDX-mapping. The surface morphologies of the fabricated electrode was investigated by FE-SEM (Fig. 1). Fig. 1a shows the pre-treated carbon fiber (CF) and clearly observed bundles of fiber bind together in the substrate. Fig. 1b shows the CoMn MOF deposited CF by hydrothermal method. It is clearly confirm the formation CoMn MOF over the CF under simple hydrothermal method. Further, the morphologies of CF was entirely changed after the deposition of CoMn MOF over CF and observed as hierarchical nanorods. This kinds of structure is very beneficial for enhanced performance of the device, in particularly electrochemical energy storage application through accessing of large electrolyte ions on its surface and reducing the distance to reach the electrolyte ions into electrode surface. Fig. 1c

shows the Fe-doped CoMn-MOF/CF. The morphologies of the CoMn/CF was obviously changed from sharp nano-needle into nanorods. It further suggests the successful doping of Fe atom into CoMn MOF /CF through phosphidation. The as-fabricated Fe-doped CoMn/CF were further utilized for electrochemical supercapacitor application. The preliminary results were derived from voltammogram clearly suggest that the material is more suitable for energy storage application.



4. Conclusions, Significance and/or Future Works

In summary, we have successfully fabricated Fe-doped CoMnP on carbon fiber substrate through hydrothermal method. The as-fabricated substrate further used to investigate the energy storage properties by cyclic voltammetry. The preliminary observations were suggested that the fabricated new electrode material is good candidate for energy storage application.

References

- [1] T Yue et al. *J. Mater. Chem. A* 9, 21799-21806, 2021.