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Defluorination-assisted heteroatom doping reaction with ammonia gas for synthesis of nitrogen-doped porous graphitized carbon

Xu Wang,^{#,a} Weimiao Wang,^{#,b} Rui Qin,^a Dazhou Xu,^a Yulong Li,^a Anping Ou,^a Wenchuan Lai,^a

Yang Liu,^a Xiangyang Liu^{*,a}

a. College of Polymer Science and Engineering, State Key Laboratory of Polymer Material and Engineering, Sichuan University, Chengdu 610065, People's Republic of China.

b. School of Materials, The University of Manchester, Oxford Road, Manchester M13 9PL, UK

* Corresponding author Tel.: +86 28 85403948; fax: +86 28 85405138.

E-mail address: lxy6912@sina.com (Xiangyang Liu *)

[#] X. Wang and W. Wang made equal contributions to this work (co-first author).

Abstract:

Nitrogen-doped porous graphitized carbon (N-F-PREGO) were synthesized by doping the fluorinated porous graphitized carbon with ammonia gas at reaction temperatures of 400 ~ 850 °C. In N-F-PREGO synthesized at 400 °C, nitrogen atoms were introduced into the porous graphene framework at a concentration of 7.9 at.%. Among which, the concentrations of the pyridinic-, pyrrolic-, and graphitic-type nitrogen species were 5.14, 1.78, and 0.99 at.%, respectively, and their percentages with respect to the total nitrogen species were 65.0, 22.5, and 12.5%, respectively. Meanwhile, the original specific surface area of 2022 m²/g and abundant meso- and microporous were well-preserved after doping process. Herein, the specific capacitance of the nitrogen-doped PREGOs was improved from 103 F/g to 294.2 F/g at a current density of 1.0 A/g. At 10 A/g, the specific capacitance was reserved at 272.5 F/g, and well retained even after 10000 cycles at 5 A/g.

Keywords: porous graphitized carbon materials; fluorination; nitrogen doping; post-synthesis

1. Introduction

Porous materials with large specific surface area have been widely applied to catalyst supports, gas separation, water purification, and electrodes for supercapacitors and fuel cells.[1-5] Among which, porous graphitized carbon material is an attractive star in porous materials family, due to its extraordinary compatibility and capacity to form chemical bonding with a series of atoms, as well as the potential to form different types of porous structure due to its designable skeleton and various

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