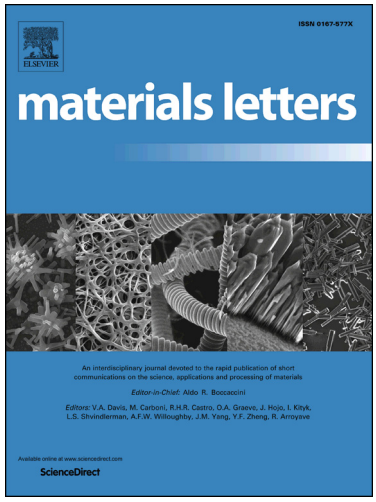

Graphene Oxide Induced Graphitic Structure in Carbon Films with High Flexibility

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Graphene Oxide Induced Graphitic Structure in Carbon Films with High Flexibility

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ABSTRACT: Free-standing carbon (FSC) films were prepared by stabilization and carbonization of graphene oxide (GO)/polyacrylonitrile (PAN) blending films. These films incorporated with reduced GO (r-GO) exhibited much better flexibility than that of the pure carbon film. The morphologies showed that the intermediate layers formed with larger and denser graphite plane structure were induced by GO template and ordered along the r-GO sheets. It was believed that the induced graphitic structure, the preferred orientation of r-GO sheets, and the defects in FSC films help to improve the flexibility of FSC films.

Keywords: Carbon materials; Microstructure; Deformation and fracture; Graphene oxide; Flexibility; Template

1. Introduction

Carbon films present attractive building blocks and have enjoyed increasing applications in a wide variety of fields, such as energy, environment, electronics, biomedical and structural sectors [1]. Carbon materials have been extensively produced by thermal pyrolysis of organic polymers which usually contain stabilization and carbonization treatments. Polyacrylonitrile (PAN) is one of the major precursor materials for carbon films due to its relatively high carbon yield and formability [2]. However, most carbon films derived from PAN to date have exhibited brittleness [3, 4]. Therefore, how to improve the flexibility of carbon films has become a key point, which can expand its potential applications.

Flexibility of carbon materials (carbon films, carbon mats or carbon fibers) are related to their microstructure, including graphitic structure, defects and so on. However, the microstructure is hard to control during the heat treatments and few researches focus on this issue. It is well known that carbon-based nanofillers possess long range, ordered graphitic structure and can serve as templating agent, which can help with the formation of graphitic crystallites during carbonization [5]. However, how the templates affect the properties of carbon materials has not been studied in detail [6]. Moreover, the flexibility of carbon films and its relationship with the graphitic structure have not received much

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