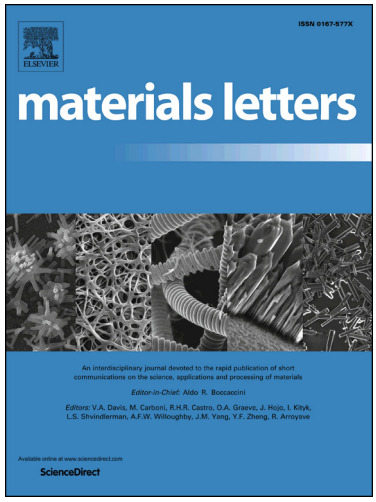

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Highly Porous Thermoplastic Composite and Carbon Aerogel from Cellulose Nanocrystals

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Abstract

Polyethylene oxide (PEO) has been used to produce a porous composite with cellulose nanocrystals via solvent-free aqueous processing and freeze-drying. This material has a microporous structure and an amphipathic nature with a high affinity for oils. The porous structure is retained after carbonisation, producing conductive carbon aerogel-like material.

Keywords

Cellulose nanocrystal, nanocellulose, polymeric composites, aerogel, oil absorption, nanocomposites

1. Introduction

Supercritical drying of gels can be used to create highly porous solid structures known as aerogels. Aerogels have recently attracted great interest due to their extremely low density, excellent heat insulation properties, large internal surface areas and liquid absorption capacity, making them desirable for a wide range of applications *e.g.* medical, environmental and aerospace technologies.[1] Aerogels can be produced from a range of materials, including silica, polymers and carbon materials including graphene. [2-4] Carbon aerogels are desired for their conductivity and high surface area and are therefore suitable as electrodes in supercapacitors and novel lithium battery designs. [1] Aerogels produced from nanocellulose are advantageous since cellulose is an abundant, sustainable biodegradable polymer. There is significant interest in the use of cellulose-based aerogels, if rendered hydrophobic, as absorbent materials for the removal of oil spills. [5]

Cellulose nanocrystals (CNCs) can be dispersed in water to form stable suspensions, allowing processing without using organic solvents which present environmental hazards. Cellulose