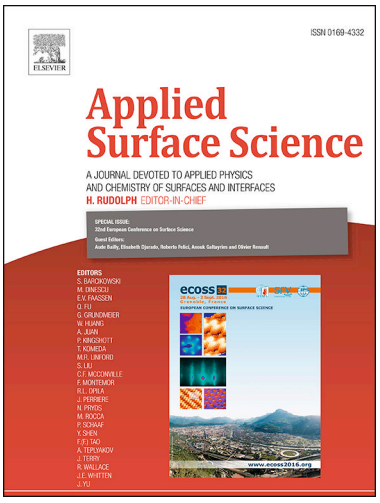

Full Length Article

Facile covalent functionalization of carbon nanotubes via Diels-Alder reaction in deep eutectic solvents

Cuong M.Q. Le, Xuan Thang Cao, Trang T.K. Tu, Won-Ki Lee, Kwon Taek Lim

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Facile covalent functionalization of carbon nanotubes via Diels-Alder reaction in deep eutectic solvents

Cuong M.Q. Le [a], Xuan Thang Cao [b], Trang T.K. Tu [a], Won-Ki Lee [c], and Kwon Taek Lim [a]*

[a] Department of Display Engineering, Pukyong National University, Busan, South Korea

[b] Faculty of Chemical Engineering, Industrial University of Ho Chi Minh City, Vietnam

[c] Department of Polymer Engineering, Pukyong National University, Busan, South Korea

Deep eutectic solvents (DESs), a new type of cost-effective ionic liquid analogues, were employed to develop a novel and efficient method for direct functionalization of multi-walled carbon nanotubes (MWNTs) via Diels-Alder (DA) click reaction. Poly(ionic liquid)s featuring furfuryl moieties (P(F-ILs)) and butyl moieties (P(B-ILs)) were synthesized by the functionalization of poly(chloromethylstyrene-alt-maleic anhydride) with 1-methylimidazole and furfuryl amine or butylamine. Then, the polymer was directly grafted on the surface of untreated MWNTs in choline : ethylene glycol (ChCl:EG) based DES without any catalyst. The successful functionalization of the polymer on MWNTs was confirmed by Raman spectroscopy, TGA, and XPS analysis. It was shown that the reaction proceeded in a very rapid fashion (less than an hour) and the use of DESs significantly improved the grafting density (more than double) as compared with the reaction in water.

Keywords Poly(ionic liquid)s; RAFT; multi-wall carbon nanotubes; Diels-Alder reaction

1 Introduction

Carbon nanotubes (CNTs) are one type of one-dimensional carbon nanomaterials that have drawn much attention for their excellent mechanical, thermal and electrical properties since the discovery of them in 1991[1]. They have been extensively applied for a variety of applications such as catalysis materials[2], electrochemistry, sensors, novel nanomaterials[3, 4], biomedical application[5-7], and so on [8]. However, due to inter-tube interaction, CNT bundles are unable to disperse in common aqueous or organic solvents and thus limit their application. To overcome this intrinsic drawback and take advantage of their properties, surface modification is imperative, typically based