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Functionalization of MWCNTs with polyvinyl alcohol through Friedel-Crafts alkylation and their composite fibers

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An effective method to increase mechanical properties of poly (vinyl alcohol) (PVA) and multi-walled carbon nanotubes (MWCNTs) composite fibers is reported. MWCNTs in the composite fibers were functionalized with PVA through one-step grafting process by Friedel-Crafts alkylation in a nondestructive aluminum chloride medium. Under suitable conditions, the resulting functionalized MWCNTs (f-MWCNTs) of selected content of 0.05 wt% based on PVA weight was added to DMSO/H_2O mixed solvent, and f-MWCNTs were highly dispersed in the solution, which remained uniform even after stayed 30 days. The solution of PVA and f-MWCNTs was gel spun and the as-spun fiber was hot drawn to prepare the final PVA/f-MWCNTs composite fibers. The tensile strength and modulus of the fibers were found to be about 926 MPa and 59 GPa which increased by 280.6% and 421.0% relative to pure PVA fibers, respectively.

Keywords: MWCNT; polyvinyl alcohol; Friedel-Crafts alkylation; composite fiber

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付克-烷基化法聚乙烯醇功能化多壁碳纳米管及其复合纤维

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本文提出了一种提高聚乙烯醇(PVA)和多壁碳纳米管(MWCNTs)复合纤维力学性能的有效方法。通过付克-烷基化法将 PVA 接枝到 MWCNTs 以使之功能化， 在合适的条件下，将 0.05 wt%（相对 PVA 重量）的功能化 MWCNTs (f-MWCNTs)加入到 DMSO/H_2O 混合溶剂，f-MWCNTs 可在溶液中高度分散，甚至在 30 天后仍保持均匀分散。将 PVA 和 f-MWCNTs 共混溶液凝胶纺丝并热拉伸， 最后制得 PVA/f-MWCNTs 复合纤维，复合纤维的抗拉强度和模量分别达到 926 MPa 和 59 GPa，与纯 PVA 纤维相比分别提高 280.6%和 421.0%。

Keywords: 多壁碳纳米管; 聚乙烯醇; 付克-烷基化; 复合纤维