

论文

纳米SiO₂改性超高分子量聚乙烯纤维的制备及其结构性能研究

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摘要 采用萃取阶段加入纳米粒子的方式, 制得纳米SiO₂改性的超高分子量聚乙烯(UHMWPE)纤维. 借助于扫描电镜、声速法、WAXD、DSC、TMA和强力测试等手段, 研究了纳米SiO₂对UHMWPE纤维结构和性能的影响. 结果表明, 纳米SiO₂粒子在UHMWPE纤维中可达到均匀分散, 分散尺寸约为50~100nm; 改性后纤维取向度、结晶度基本不变, 纤维横晶粒尺寸大大降低, 纤维力学强度稍有增加, 力学模量大大增加(由1359.2cN/dtex增加到1505.9cN/dtex), 同时, 纤维热性能和热力学性能也得到大大改善.

关键词 [UHMWPE纤维](#) [纳米SiO₂](#) [结构](#) [性能](#)

分类号

PREPARATION AND STUDIES ON THE STRUCTURE AND PROPERTIES OF ULTRAHIGH MOLECULAR WEIGHT POLYETHYLENE/NANO-SiO₂ COMPOSITE FIBERS

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Abstract UHMWPE/nano-SiO₂ composite fibers were prepared by the method of adding nano-SiO₂ in extracting stage, and the influence of nano-SiO₂ on the structure and properties of UHMWPE fibers were determined by SEM, sonic orientation, WAXD, DSC, TMA and mechanical measurements. The results showed that nano-SiO₂ particles diffused into UHMWPE gel fibers during the extracting stage, and they could be dispersed in halo-size in UHMWPE fibers. Compared to virgin UHMWPE fibers, the orientation and crystallinity of UHMWPE/nano-SiO₂ composite fibers remained unchanged, while the crystal size decreased greatly. After incorporating nano-SiO₂, UHMWPE fibers became both stiffer and tougher than the virgin ones, especially the fiber modulus, which was increased greatly from 1359.24 cN/dtex to 1505.90 cN/dtex. Meanwhile, nano-composite UHMWPE fibers displayed a better thermal and thermomechanical stability.

Key words [Ultra-high molecular weight polyethylene fiber](#) [Nano-SiO₂](#) [Structure](#) [Properties](#)

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