

Ultradrawing and Ultimate Tensile Properties of Ultrahigh Molecular Weight Polyethylene Composite Fibers Filled with Activated Nanocarbon Particles with Varying Specific Surface Areas

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Abstract : Original and/or functionalized activated nanocarbon particles with a quoted specific surface area of 100, 500, 1000 and 1400 m²/g, respectively, were used to investigate the influence of specific surface areas of activated nanocarbon on ultra drawing and ultimate tensile properties of ultrahigh molecular weight polyethylene (UHMWPE), UHMWPE/activated nanocarbon and UHMWPE/ functionalized activated nanocarbon fibers. The specific surface areas of well dispersed functionalized activated nanocarbon in UHMWPE/functionalized activated nanocarbon fibers can positively affect their ultra drawing, orientation, ultimate tensile properties and “micro-fibril” characteristics. Excellent orientation and ultimate tensile properties of UHMWPE/nanofiller fibers can be prepared by ultra drawing the UHMWPE/functionalized activated nanocarbon as-prepared fibers with optimal contents and compositions of functionalized activated nanocarbon. The ultimate tensile strength value of the best prepared UHMWPE/functionalized activated nanocarbon drawn fiber reached 8.0 GPa, which was about 2.86 times of that of the best-prepared UHMWPE drawn fiber prepared in this study. Specific surface area, morphological and Fourier transform infrared analyses of original and functionalized activated nanocarbon and/or investigations of thermal, orientation factor and ultimate tensile properties of as-prepared and/or drawn UHMWPE/functionalized activated nanocarbon fibers were performed to understand the above-improved ultra drawing and ultimate tensile properties of the UHMWPE/functionalized activated nanocarbon fibers.

Keywords : activated nanocarbon, specific surface areas, ultradrawing, ultrahigh molecular weight polyethylene

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