Toetab TÜ ja TTÜ doktorikool
"Funktsionaalsed materjalid ja tehnoloogiad" (FMTDK)

ESF projekt 1.2.0401.09-0079

PREPARATION AND CHARACTERIZATION OF FUNCTIONALIZED CARBON NANOTUBE FIBERS

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Carbon nanotubes (CNT's) are extraordinary materials due to their several superior properties like ultra-high strength (~150 GPa), Young's modulus (~1 TPa), chemical stability, thermal and electrical conductivity [1,2]. Despite the exceptional mechanical and electrical properties of individual CNTs the transference of these properties to macro-scale has remained problematic. However, development of CNT-fiber technology may take a noticeable step towards this goal. The aim of this work is to develop fibers from neat and functionalized CNTs to provide strong lightweight alternatives to metal wires.

For preparing long aligned CNT-fibers a dielectrophoresis method has been suggested [3,4]. Dielectrophoresis is a facile method for CNT-fibers preparation, as it precisely enables to vary the essential preparation parameters that determine the structure of the fiber, like concentration of the CNT solution, drawing speed, operational voltage and frequency.

In current study different preparation parameters are investigated to reveal the trendlines and potential of the method. Obtained fibers are tested in terms of important characteristics, like density, tensile strength, Young's modulus, and conductivity. Typical as-grown fibers show the following performances: diameter 1–200 μm, length up to 10 cm, density 0.2–0.5 g cm^{-3}, tensile strength up to 150 MPa, Young's modulus 5,5 GPa, and conductivity ~10^3 S/m. It is shown that proper chemical treatment can significantly improve these parameters. For technological feasibility, a new method utilizing UV-curable cross-linking agents is proposed.

References

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