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学位論文題目	Study on the Multi-Functional Electrospun Nanofibers and Their Applications (多機能性ナノファイバーの創製および応用に関する研究)
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論 文 内 容 の 要 旨

The design and development of electrospun polymer fibers with sub-micrometer diameters from various kinds of materials has gained significant attention due to several amazing characteristics such as very large surface area to volume ratio, flexibility in surface functionalities, and superior mechanical performances, which make the polymer nanofibers to be optimal candidates for many important applications, such as electronics, medicine, sensor, and controlled release technology, etc. However, despite of the potential mentioned above, the application of nanofibers has been limited due to its poor mechanical properties. In a recent year, to maximize the good properties and complement the weaknesses, the combined technologies for producing the functional composite nanofibers incorporating various nano-objects (such as carbon nanotubes, ceramics metal nanoparticles, etc) in a broad range of areas such as electronics, medicine, sensor, and controlled release technology are being conceived these days.

Carbon nanotubes (CNTs) have attracted great attention as ideal fillers for reinforcement because of their unique physical and mechanical properties since the discovery by Ijima. To date, the reinforcement of both single wall carbon nanotubes (SWNTs) and multiwalled carbon nanotubes (MWNTs) on polymer composites has received great attention. Up to date, PVA/CNT composite materials have been widely studied since the hydroxyl groups of the PVA and the carboxyl groups of the modified CNTs can form strong interaction via hydrogen bonding. Although a lot of works have been done to learn the interfacial interactions between the carbon nanotubes and the polymer chains and the load-transfer efficiency from the polymer to the carbon nanotubes, few people studied how pH value of the polymer/acid-treated MWNT solution affects the connections between the MWNT and polymer matrix. We report the influence the pH of the aqueous PVA/MWNT dispersion solution on the morphology and mechanical properties of the corresponding electrospun PVA/acid-treated MWNT composite nanofibers.

The ferric hexacyanoferrate ($\text{Fe}_4^{\text{III}}[\text{Fe}^{\text{II}}(\text{CN})_6]_3$) is well known as Prussian blue (PB), often used as an efficient adsorbent for the removal of radioactive cesium (Cs)

from the wastewater. Developing an efficient, stable and easily handleable PB nanoparticles-based material for the removal of Cs remains an highly demanding issue. Metal nanoparticles-based PVA composite nanofibers have been extensively used for several applications. In fact, PVA is largely available, highly hydrophilic, easily processable, biocompatible, non-toxic and chemical resistive. We report a new Prussian blue nanoparticle (PBNPs) incorporated polyvinyl alcohol (PVA) composite nanofiber (*c*-PBNPs/PVA) for a rapid adsorption of Cs from the radioactive wastewater. Inductive coupled plasma-mass spectroscopy (ICP-MS) was used to measure the Cs adsorption activity of the *c*-PBNPs/PVA in wastewater. Therefore, the simple preparation, easy separation and faster Cs adsorption activity expect *c*-PBNPs/PVA as an alternate choice to the existing PBNPs-composite materials.

Metal nanoparticles (MNPs) have played a tremendous role as heterogeneous catalysts in various organic reactions. Particularly, supported MNPs catalysts are preferred over the unsupported MNPs due to their simple separation and. Till date, several supported MNPs catalysts are reported for various organic reactions. Electrospun nanofibers (NFs) including cellulose nanofibers (CNFs) have attracted much attention due to their unique properties such as large surface area to volume ratio, biocompatibility, simple surface functionalization, easy handling and outstanding mechanical properties. The CNFs and their composites have been used for various potential applications such as sensors, energy, catalysis, biomedical, separators and filters. We have prepared noble MNPs supported on CNFs (RuNPs/CNFs and AgNPs/CNFs) by a simple reduction method. After complete characterization, the RuNPs/CNFs and AgNPs/CNFs were used as nanocatalysts for the oxidation of benzyl alcohol and *aza*-Michael reaction respectively.