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学 位 (博 士) 論 文 要 旨
(Doctoral thesis abstract)

論文提出者 Ph.D. Candidate	生物システム応用科学府 <u>生物機能システム科学</u> 専攻 博士後期課程 <u>第 1</u> 専修/グループ(Department Course) 平成 <u>28</u> 年度入学(Your Entrance Fiscal Year) 氏名 <u>Liu Changchun</u> 印 (Your Name(Family, First) and Seal)				
主指導教員 氏 名 Chief Advisor's Name	荻野 賢司	副指導教員 氏 名 Vice Advisor's Name	富永 洋一	副指導教員 氏 名 Vice Advisor's Name	
論文題目 Title	Study on Technology and Properties of Silver Plating on Flexible Substrate フレキシブル基板上の銀メッキの技術と特性に関する研究				
論文要旨 (和文要旨(2000 字程度)または英文要旨(500words)) ※欧文・和文どちらでもよい。但し、和文の場合は英訳を付すこと。 Write a summary in Japanese (2000 characters) or in English (500words). If the abstract is written in Japanese, needed to translate into English. Polyester (PET) fiber is widely used as a flexible substrate in various fields because of its excellent properties. But its Plating silver on PET surface enables it to have both the original properties of the PET and silver's excellent characteristics. Electroless plating is a simple and cost-effective method to coat a nano-silver layer on fibers in order to obtain conductive textiles. However, the electroless silver-plated fibers do not have enough bonding strength between the surface silver layer and substrate generally. This work aimed to improve bonding between silver and substrate (PET fibers and the filter paper). In details, this work of silver plating on the flexible substrate could be divided into the following parts as: 1) Prepared the silver-coated polyester fibers with good electrical conductivity by a continuous two-step method, which combined the operations of continuous electroless plating without an activation step and subsequent cyanide-free electroplating step. Furthermore, specialized equipment for the continuous plating of silver on the PET fibers was designed. The influence of the power supply method, control voltage, and electroplating time on electroplating silver was studied. The optimal conditions for electroplating silver conductive polyester fibers should include the power supply method having a constant voltage power, the best control voltage range of 1.5–2.0 V, and an electroplating time of 4 min. The results demonstrated that after the continuous two-step silver plating, the surface coating of the fiber was obviously thickened, and the surface silver particles were denser and continuous, with better mechanical properties and washability. The electrical resistivity reached $2.3 \times 10^{-4} \Omega \cdot \text{cm}$, and the conductivity was obviously improved. 2) Prepared the composite conductive fibers by the two-step deposition of polyaniline (PANI) and silver layer on the surface of PET fibers through oxidative polymerization and redox reaction, respectively. Batch experimental results					

showed that the concentration of reagents and the reaction time could affect the resistance of polyaniline-silver coated conductive fibers. The optimal reaction condition of preparing conductive polyester fibers should be: the concentration of aniline was 0.3 mol/L, ammonium persulfate 0.2 mol/L, nitric acid 1 mol/L and the treating time was 3 min. The analysis results demonstrated that the PANI-Ag-coated polyester fibers by the two-step depositing have much better properties than Ag-coated fibers.

3) Uniform copper patterns with good conductivity properties were obtained on a flexible filter paper/polyacrylonitrile (FP/PANI) film. The pattern of Ag nanoparticles was first produced on an Ag⁺-doped FP/PANI composite film using a pulsed laser source, followed by selective electroless plating of copper using the metal silver nanoparticles as activated seeds. The in-situ reductions of silver particles and the formation of the silver agglomeration patterns were induced by laser irradiation technology on the FP/PANI/AgNO₃ composite film. The morphology of metal particles on the fabric surface and the conductivity of copper deposited patterns were characterized. The experimental results demonstrated that the scanning speed of the laser pulse greatly affected the redox reaction. The current-voltage curve indicated that the copper patterns on the FP/PANI composite films had good conductivity.

(英訳) ※和文要旨の場合(300 words)

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