Functionalization of Textile Materials by Coating with Conjugated Polymers

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During the last decade, smart textiles have attracted an enormous attention of researchers and found extraordinary applications in biomedical, sports, defense, energy, and fashion industry. These textiles are able to accept the physical signals from external stimuli and then generate a reaction in the form of thermal, electrical, chemical and magnetic signals. They should be in the form of functionalized fabric or electro-active fibers. A numerous techniques for the production of electrically conductive fibers have already been developed. In this study, we have prepared relatively highly conductive fibers with better mechanical properties. For this purpose, we have functionalized the commercially available textile fibers by coating with intrinsically conductive polymer (ICP), poly(3,4-ethylenedioxythiophene) (PEDOT). An efficient coating technique, so called oxidative chemical vapor deposition (CVD) was utilized for making uniform, thin and highly conductive polymer layers on the surface of textile fibers. For our initial experiments, we used viscose and polyester fibers as substrate materials. After performing a series of experiments, we have optimized a number of reaction parameters at which good electro-mechanical properties of conductive fibers can be achieved. At specific reaction conditions, the conductivity level which we have attained is approximately 15 S/cm. The PEDOT coated viscose and polyester fibers were compared in order to find out the best suitable substrate material. For increasing the service life of obtained conductive fibers, a thin layer of silicon resin was applied on the surface of PEDOT coated fibers.

In our research, we have also prepared micro-porous conductive membranes by coating cellulosic non-woven fabrics with conductive polymer PEDOT. These conductive membranes are the highly demanding materials in the field of bio-fuel generation, bio-electrodes, sensors and anti-static air filter systems. The conjugated polymer based conductive membranes can effectively be utilized for above mentioned applications because they have better conductivity, lower weight, flexibility and cost effectiveness.