



Plasma treatment and surface nanocoating in textiles

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Abstract

The use of new techniques applied to the development of new materials, devices or systems in nano-metrics scale is increasing in recent years. These new materials are receiving higher attention because of their potential applications in microelectronics, photo catalysis, magnetic devices, powder metallurgy, renewable energies, biology and textiles. Textile industries are using a new technology nano-coating, which is the application of a thin film of a material polymeric or not in a textile material. Applied nanocoatings in textiles, clothing and textile for footwear have the objective to develop materials with properties antimicrobial, water repellence, soil resistance, anti-static, anti-infrared, flame-retardant properties, dyability, colour fastness and strength of textile materials. Researchers are inspired to mimic nature in order to create clothing materials with higher levels of functions and smartness. Textiles have mechanical, aesthetic, and material advantages that make them ubiquitous in both society and industry. The work presented is part of a project that integrates textile design with thermo-chromic particles, conductive fibers and smart nano-coatings as well as sensor based systems to create a dynamic changing pattern and smart wearable fabrics.

One of the methods that can be used in the nano-coating process is the Physical Vapor Deposition (PVD) to sputter the atoms onto the substrate. This technique consists in the removal of atoms or atom clusters from the target material and their deposition (in the solid phase) as a thin film deposited on a sample (metallic, glass, polymeric). Currently, magnetron sputtering is an usual process of production in the industry and in the laboratory. A growing interest is being given to the application of this technique to textile materials (technical textile, nonwoven). Due to the growth and the development of new materials, the main purpose of this work is to study the surface properties that a textile fiber, the PLA (Poly (lactic acid)) fibers, after plasma treatment and nano-coating with several nanocomposite inorganic PVD layers. In the present study, the PLA fibers were coated with a nano-film based on TiO_x, presenting different properties such as self-cleaning, anti-bactericide, and thermo-resistance.

The system used in the nanocoating process is a magnetron sputtering RF Alcatel 650 with load-lock (pre-camera for samples introduction and also used for samples surface treatment for better thin films adhesion) and a

system for pulsed DC magnetron sputtering. The gases used are argon as inert gas, and oxygen as reactive gas. The first step of the work was to study the influence of the surface treatment in PLA fibers by plasma (RF, Alcatel)