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Layer-By-Layer Deposition of Poly(Ethylene Imine) Nanolayers on Polypropylene Nonwoven Fabric: Electrostatic and Thermal Properties

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Abstract : The surface properties of many materials can be readily and predictably modified by the controlled deposition of thin layers containing appropriate functional groups and this research area is now a subject of widespread interest. The layer-by-layer (lbl) method involves depositing oppositely charged layers of polyelectrolytes onto the substrate material which are stabilized due to strong electrostatic forces between adjacent layers. This type of modification affords products that combine the properties of the original material with the superficial parameters of the new external layers. Through an appropriate selection of the deposited layers, the surface properties can be precisely controlled and readily adjusted in order to meet the requirements of the intended application. In the presented paper a variety of anionic (poly(acrylic acid)) and cationic (linear poly(ethylene imine), polymers were successfully deposited onto the polypropylene nonwoven using the lbl technique. The chemical structure of the surface before and after modification was confirmed by reflectance FTIR spectroscopy, volumetric analysis and selective dyeing tests. As a direct result of this work, new materials with greatly improved properties have been produced. For example, following a modification process significant changes in the electrostatic activity of a range of novel nanocomposite materials were observed. The deposition of polyelectrolyte nanolayers was found to strongly accelerate the loss of electrostatically generated charges and to increase considerably the thermal resistance properties of the modified fabric (the difference in T50% is over 20°C). From our results, a clear relationship between the type of polyelectrolyte layer deposited onto the flat fabric surface and the properties of the modified fabric was identified.

Keywords : layer-by-layer technique, polypropylene nonwoven, surface modification, surface properties
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