

Water-Repellent Finishing on Cotton Fabric by SF₆ Plasma

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Abstract : Low-pressure, sulfur hexafluoride (SF₆) remote radio-frequency (RF) plasma, ignited in a hollow cathode discharge (HCD-L300) plasma system, has been shown to be a powerful method in cotton fabric finishing to achieve water-repellent property. This plasma was ignited at an SF₆ flow rate of (200 cm), low pressure (0.5 mbar), and radio frequency (13.56 MHz) with a power of (300 W). The contact angle has been measured as a function of the plasma exposure period using the water contact angle measuring device (WCA), and the changes in the morphology, chemical structure, and mechanical properties as tensile strength and elongation at the break of the fabric have also been investigated using the scanning electron microscope (SEM), energy-dispersive X-ray spectroscopy (EDX), attenuated total reflectance Fourier transform Infrared spectroscopy (ATR-FTIR), and tensile test device, respectively. In addition, weight loss of the fabric and the fastness of washing have been studied. It was found that the exposure period of the fabric to the plasma is an important parameter. Moreover, a good water-repellent cotton fabric can be obtained by treating it with SF₆ plasma for a short time (1 min) without degrading its mechanical properties. Regarding the modified morphology of the cotton fabric, it was found that grooves were formed on the surface of the fibers after treatment. Chemically, the fluorine atoms were attached to the surface of the fibers.

Keywords : cotton fabric, SEM, SF₆ plasma, water-repellency

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