

Solvent-Free Conductive Coatings Containing Chemically Coupled Particles for Functional Textiles

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Abstract : The surge in the usage of wireless electronics and communication devices has engendered a different form of pollution, viz. the electromagnetic (EM) pollution and yet another serious issue, electromagnetic interference (EMI). There is a legitimate need to develop strategies and materials to combat this issue, otherwise leading to dreadful consequences. Functional textiles have emerged as the modern materials to help attenuate EM waves due to the numerous advantages - flexibility being the most important. In addition to this, there is an inherent advantage of multiple interfaces in coated fabrics that can engender significant attenuation. Herein we report a coating having multifunctional properties - capable of blocking both UV and EM radiation (predominantly of the microwave frequencies) with flame-retarding properties. The layer described here comprises iron titanate(FT) synthesized from its sustainable precursor - ilmenite sand and carbon nanotubes (CNT) dispersed in waterborne polyurethane. It is worth noting that FT's use as a multifunctional material is being reported for the first time. It was observed that a single layer of coated fabric shows EMI shielding effectiveness of -40 dB translating to 99.99% attenuation and similarly a UV blocking of 99.99% in the wavelength ranging from 200-400 nm. The microwave shielding properties of the fabric were demonstrated using a Bluetooth module - where the coated fabric was able to block the incoming Bluetooth signals to the module from a mobile phone. Besides, the coated fabrics exhibited phenomenal enhancement in thermal stability - a five percent increase in the limiting oxygen index (LOI) was observed upon the application of the coating. Such exceptional properties complement cotton fabrics' existing utility, thereby extending their use to specialty applications.

Keywords : multifunctional coatings, EMI shielding, UV blocking, iron titanate, CNT, waterborne polyurethane, cotton fabrics

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