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# A study on materials for radiofrequency electromagnetic interference shielding: metamaterials, nanomaterials and textiles

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The continuous developments in radiofrequency electromagnetic (EM) radiation applications such as communication technologies, data transference, wireless internet, automatized electronics, etc., has been consistently increasing EM radiation exposition. For this reason, the scientific community is questioning the impact that EM radiation could cause in the human health or affect electronic appliances operations [1]. To overcome these issues, electromagnetic interference (EMI) shielding has been extensively investigated and applied as a solution.

The EMI shielding field is dominated by the use of metals such as silver or nickel. However, the use of these materials introduces some challenges, namely lack of flexibility, corrosion, high cost or heavy weight. For these reasons, alternative approaches such as the use of carbon materials, conductive polymers, magnetic materials, metal oxides and nanocomposites, have been investigated [2]. Metamaterials for improving other properties such as breathability, optical transmittance and reducing material's usage could also be considered. Textiles are versatile solutions for EMI shielding, for being flexible, lightweight and applicable for clothing, electronic protection, aerospace application, etc.

In this work, diverse materials are considered, namely carbon nanomaterials, conductive polymers, and commercial metallic inks. Different applications techniques in textiles are investigated, such as dip-coating, screen-printing and coating. The EMI shielding properties were measured using an adaptation of the transmission line test including conjoined wave-guides connected to a vector network analyzer (VNA), where the sample is inserted in the middle and the scattering parameters are obtained. It was possible to obtain the shielding effectiveness (SE) in decibel (dB), in the frequency range from 5.85 to 18 GHz. Additionally, a simulation on COMSOL Multiphysics was applied for studying quadrangular metallic meshes.

Promising results were obtained with coatings of PEDOT: PSS and MWCNTs formulations applied over cotton textile substrates, reaching SE considered to be excellent for general use applications and very good for professional applications [3]. Furthermore, results from simulations bring interesting perspectives for reducing material's usage while maintaining similar SE levels.

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