Influence of Structural Parameters on the Electrical Properties of Electroconductive Embroideries

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Abstract

Electroconductive embroideries represent a modern class of functional materials with applications in wearable electronics, sensing systems, and frequency selective surfaces (FSS) (1,2). Due to their ability to be integrated with textile substrates, they combine electrical properties with flexibility and low weight, making them particularly attractive for user comfort applications such as heating systems and automotive interior components (3,4). Their electrical performance depends on a range of technological parameters, including the type of conductive yarn, stitch geometry, and surface coverage.
The main objective of this study was to fabricate an embroidered structure consistent with prior computational simulations. For this purpose, a series of samples was prepared, differing in embroidery fill density, the type of electroconductive yarn used, and economic parameters. The samples were characterized using the Van der Pauw method to determine sheet resistance and assess structural anisotropy. Based on the obtained results, variants were identified that provide optimal electrical conductivity while maintaining cost-effective production.

The results demonstrate a significant influence of embroidery structural parameters on electrical properties, enabling the informed design of materials with tailored characteristics. The developed structures may find applications in flexible electronic systems, electromagnetic shielding, and smart textiles with sensing functionalities. The findings provide a basis for further research on optimizing embroidery geometries and their integration with advanced microwave engineering systems.

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