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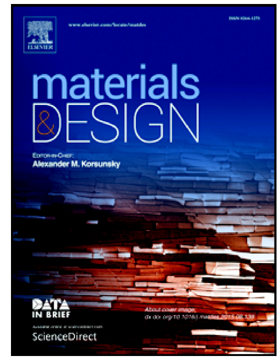

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A Novel Thermo-Tunable Band-Stop Filter Employing a Conductive Rubber Split-Ring Resonator

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Abstract

This paper presents the design and related applications of a thermally tunable band-stop filter employing conductive rubber that incorporates electrically conductive particles. The relationship between the environmental temperature and the volume resistivity of conductive rubber materials was experimentally established. The experimental results demonstrated that the conductive rubber has a temperature-sensitive resistance property. The conductive rubber material was employed in the design of a C-shaped split-ring resonator (SRR) structure. The influence of environmental temperature on the electromagnetic properties of the SRR structure was analysed using a numerical simulation and experimental testing. The results demonstrated that the design of thermally tunable metamaterials was possible. As such, an H-shaped conductive rubber SRR was employed in the design of a novel thermally tunable band-stop filter. The results of a numerical simulation and experimental testing verified its band-stop characteristic, and demonstrated that the filtering performance of the H-shaped conductive rubber SRR can be controlled by the environmental temperature. Lastly, by comparison of the effective dielectric properties of the two types of SRRs, it demonstrates the effectiveness of conductive rubber and their temperature-controllable band-stop characteristics.

Keywords: Conductive Rubber, Temperature Control, Split-Ring Resonator, Band-Stop Filter.

1. Introduction

The split-ring resonator (SRR) is an essential component of microwave metamaterials and has its theoretical basis in Veselago's work about left-handed metamaterial in the late 1960s [1].

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