

Effect of Pretreatment on the Electrical Properties of Bismuth Ferrite/PVDF Deposited on Cotton Knitted Fabric

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Structured Abstract

Background: Bismuth Ferrite (BiFeO_3) is a piezoelectric material renowned for its application in sensors and nanogenerators. Nevertheless, more research has yet to explore the integration of BiFeO_3 into the textile fabric to create conductive fabric. Furthermore, there are fewer studies evaluating pretreatment's impact on the electrical properties, deposition process, and durability of the $\text{BiFeO}_3/\text{PVDF}$ treatment on traditional knitted cotton fabric. The objectives of the study are to evaluate the effect of pre-treatment on the electrical properties and treatment durability of Bismuth Ferrite/PVDF deposition on cotton knitted fabric.

Methods: Cotton knitted fabric underwent varying pretreatment levels, including washing, washing + scouring + washing, and washing + scouring + bleaching + washing. Pretreated samples were then treated using $\text{BiFeO}_3/\text{PVDF}$ solution through dip coating. The curing process occurred at 85°C for 2 hours. The durability of each sample against perspiration was assessed to replicate sweat effects. Throughout the experiment, SEM, FTIR, and XRD analyses were conducted before and after each treatment. Fabric samples were sandwiched with conductive fabrics and subjected to electrical property tests using an oscilloscope.

Results: The results indicated a significant enhancement in electrical properties with increasing pretreatment levels. Among pretreated samples, the bleaching sample exhibited the highest potential voltage (0.3 V), while the controlled sample displayed the lowest voltage (0.0014 V). Upon treatment with $\text{BiFeO}_3/\text{PVDF}$, voltage generation increased with increasing pretreatment level. After subjecting the samples to a durability test involving perspiration in an alkaline condition, the scouring sample displayed the highest potential voltage (3.82 V), and the controlled sample displayed the lowest potential voltage (1.34 V) for the $\text{BiFeO}_3/\text{PVDF}$ treated samples.

Conclusion: Varied pretreatment levels strongly influence the electrical properties, deposition process, and durability of Bismuth Ferrite/PVDF treatment on cotton knitted fabric. The interaction between the pretreatment chemicals and treatment chemicals plays a crucial role, as the specific chemical treatments and their reactions with $\text{BiFeO}_3/\text{PVDF}$ lead to differing effects on pretreatment outcomes. This interaction directly impacts the electrical properties of the treated fabrics.

Keywords: PANI, Textile Pretreatment, Durability Performance, Electrical Properties

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