In situ synthesis and immobilization of zinc oxide nanowires onto cotton fabrics

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Abstract: Zinc oxide (ZnO) has many functional properties such as nontoxic, photocatalytic activity, UV resistant, antibacterial and *piezoelectric* properties. Zinc oxide nanostructures are used in the catalytic reaction process due to their large surface area and high catalytic activity [1], [2]. In this study, the growth of ZnO nanowires (NWs) was carried out on cotton fabrics via the hydrothermal method. Our findings showed that microwave radiation had a significant effect on the structure and growth of the ZnO NWs (Figure 1). Additionally, microwave radiation had a notable influence on the antibacterial and UV protection properties of the coated cotton fabrics. The ZnO NWs-grown cotton fabrics exhibited an excellent bactericidal ability against both types of Gram-negative and Gram-positive bacteria and also demonstrated an outstanding UV protection performance against harmful UV radiations. The UV blocking was found to increase with an increase in the density and size of the NWs (Table 1). The NWs-grown fabrics showed excellent UV protection performance. The cotton fabrics immobilized with ZnO NWs exhibited a 100% reduction against both bacterial strains and a UPF value of 40+ required for excellent UV protection. Moreover, ZnO is generally nontoxic and may not cause any environmental challenges. Hence; the as-prepared cotton fabric could be used for a wide range of functional applications.

Keywords: Nanowires, Cotton fabric, Antibacterial, UV-protection.

Table 1 UV-blocking of the ZnO nanowires.

Samples	UPF and percent UV blocking of samples for UV-A and UV-B radiation		
	UPF	UVA Blocking %	UVB Blocking %
Control cotton	4	71.5	78.8
S1	40+	92.9	98.2
S2	40+	93.8	98.5
S3	40+	94.9	99

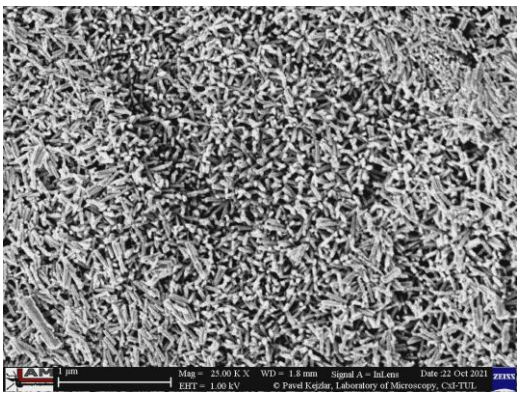

Figure 1 SEM images of ZnO NWs grown on cotton fabric

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