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Abstract

Strain Sensor Based on Biological Nanomaterial †

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Abstract: We investigated a prototype of a strain sensor based on the layers of a bionanomaterial containing bovine serum albumin (BSA matrix) and multi-walled carbon nanotubes (MWCNT filler). The aqueous dispersion of 25 wt.% BSA/0.3 wt.% MWCNT was applied by screen printing onto flexible polyethylene terephthalate substrates. After drying the layers by laser irradiation (~970 nm), various parameters of the layers were controlled, i.e., resistance *R*, bending angle θ, number of cycles n, and measurement time. One measurement cycle corresponded to a change within the range θ = ±150°. The layers of the BSA/MWCNT bionanomaterial had dimensions of (15 ÷ 20) mm × (8 ÷ 10) mm × (0.5 ÷ 1. 5) μm. The dependences of resistance R on the bending angle θ were similar for all layers at θ = ±30, and the *R*(θ) curves represented approximate linear dependences (with an error of ≤ 10%); beyond this range, the dependences became nonlinear. The following quantitative values were obtained for the investigated strain sensor: specific conductivity ~1 ÷ 10 S/m, linear strain sensitivity ~160, and bending sensitivity 1.0 ÷ 1.5%/°. These results are high. The examined layers of the bionanomaterial BSA/MWCNT as a strain sensor are of particular interest for medical practice. In particular, strain sensors can be implemented by applying a water dispersion of nanomaterials to human skin using a 3D printer for monitoring movements (arms and blinking) and the detection of signs of pathology (dysphagia, respiratory diseases, angina, etc.).

Keywords: strain sensor; bovine serum albumin; multi-walled carbon nanotubes; laser irradiation; strain sensitivity

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