Impedimetric multifunctional Sensor Based on Rubber-CNTs-orange Dye Nanocomposite Fabricated by Rubbing-in Technology

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This study presents the fabrication and investigation of rubber-carbon nanotubes-orange dye (rubber-CNTs-OD) nanocomposite based resistive and impedimetric sensors. These shockproof multifunctional sensors may be used for displacement, pressure, force, humidity and temperature sensing. Rubbing-in technology was used to fabricate the coplanar sensors on rubber substrates of dimensions 12x5x5 mm³. In the middle of the substrates, the OD-CNTs mixture (1:1 wt.%) was rubbed-in to make 3 mm wide and 12-18 μ m deep active layer. On both sides of the active layer the rubber-CNTs layers were formed, that act as conductive electrodes. The length, width and the thickness of the electrodes were 4-5 mm, 5 mm and 12-18 μ m, respectively. The resistance and the impedance of the sensors decreased under the effect of compressive displacement, pressure, humidity and temperature. These reductions were -43 Ω/μ m to -73 Ω/μ m, -3950 $\Omega\text{-cm}^2/\text{kgf}$ to -6008 $\Omega\text{-cm}^2/\text{kgf}$, -187 $\Omega/\%\text{RH}$ to -981 $\Omega/\%\text{RH}$ and -216 $\Omega/^\circ\text{C}$ to -270 $\Omega/^\circ\text{C}$, respectively. The force (in perpendicular direction to the length) causes to increase the resistance and impedance (60 Ω/gf to 300 Ω/gf). The probable reasons of the observed changes in the resistance and impedance of the sensor have been described.

Keywords: Semiconductor; Shockproof; Displacement sensor; Force sensor; Pressure sensor; Humidity sensor; Temperature sensor.

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