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Silver Nanowire Incorporated Wearable Thermogenic Smart Textiles Designed for Continuous Body Temperature Measurements

K.B. Dhanawansha [1], G.K.R. Senadeera [2], R.T. Munasinghe [3], B.S. Dassanayake [1]

[1]*Department of Physics, University of Peradeniya, Peradeniya, Sri Lanka*
[2]*Department of Physics, The Open University of Sri Lanka, Nawala, Nugegoda, Sri Lanka*
[3]*Dept. of Electrical and Electronics, Faculty of Engineering, University of Peradeniya, Sri Lanka*
Email: buddhikad@pdn.ac.lk

Abstract

Conventional fabrics that have modified in to conductive fabrics by using conductive nanomaterials have novel applications in different fields. This kind of fabrics can be used as heat generators with the help of Joule heating mechanism, which is applicable in thermal therapies and to maintain the warmth in cold weather conditions in a wearable manner. The modified fabric can also be used as a wearable sensor for body temperature measurements using the variation of resistance with respect to the body temperature deviations. In this study polyol synthesized silver nanowires (Ag NWs) are incorporated to bare cotton fabrics by using simple drop casting method. The variation of sheet resistance of the fabrics with respect to the incorporated mass of Ag NWs was measured by using four probe technique while the bulk resistance variation with respect to the temperature was measured using ohm meter. Heat generation profiles of the fabrics were investigated by using FLIR T640 thermo graphic camera. Incorporation of 30 mg of Ag NWs in an area of 25 cm^2 of the cotton fabric gave electrically conductive fabrics which can be heated up to a maximum steady state temperature (at which heat generating rate is equal to the heat dissipation rate) of 45 °C, using a 9 V battery, with a resistance variation of 0.2 $\Omega\ °C^{-1}$. A simple microcontroller circuit was used to actuate the cotton as a heat generating wearable temperature sensor.

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