Hybrid Composites of Poly (diphenylamine sulfonic acid) and nano-Alumina for Impedimetric Humidity Sensors

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In this paper, nano-hybrid composites of water-soluble, conducting polymer poly (diphenylamine sulfonic acid) (PSDA) with nano- Al_2O_3 and (3-mercaptopropyl) trimethoxysilane (MPTMS) have been prepared to construct the interdigitated impedimetric type of humidity sensors. Humidity sensing characteristics of the sensors including the sensitivity, hysteresis, response/recovery time, repeatability and long-term stability were investigated. The performances of the studied sensors have been discussed by taking into consideration the film composition and applied alternating current frequency. The best results were obtained for the composite with a weight percentage of 50% Al_2O_3 , which exhibits good linearity ($R^2=0.9949$), high sensitivity (three orders of impedance change), rapid response (55 s and 65 s at 1 kHz and 100 kHz, respectively) and recovery (155 s and 55 s at 1kHz and 100 kHz, respectively) times, low hysteresis (<4%RH), good repeatability (RSD<1%) and long-term stability (RSD<5%) in the whole relative humidity range of 10-95%. These results show that PSDA-MPTMS- Al_2O_3 nanocomposites are promising materials for impedimetric humidity sensors.

Keywords: Humidity sensor, poly (diphenylamine sulfonic acid), alumina, nanocomposite, impedance measurement.

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