COINAPO
COMPOSITE MATERIALS OF INORGANIC NANOTUBES AND POLYMERS

3rd Composites of Inorganic Nanotubes & Polymers Topical Meeting

Inorganic nanomaterials and their composites: from fabrication to applications

2nd – 3rd of March 2011

in

Sestriere, Italy

cost

iit @POLITO

European Cooperation in the field of Scientific & Technical Research

International Frequency Sensor Association

Italian Institute of Technology

Associazione Tecnica Dell'Automobile

Published by
Italian Institute of Technology @ POLITO
C.so Trento 21
10129 Torino
Italy

Complex method for describing polyisoprene/conductive nanotube composite gas sensing properties

G. Sakale[1], M. Knite[1], V. Teteris[1], J. Zavickis[1], I. Aulika[2], P. Civera[3], D. Demarchi[3]

[1] Riga Technical University, Institute of Technical Physics, Riga, Latvia
[2] Center for Space Human Robotics - IIT@Polito, Corso Trento 21, 10129, Turin, Italy
[3] Electronics Department, Politecnico di Torino, Corso Duca degli Abruzzi 24, 10129, Turin, Italy
e-mail: knite@latnet.lv

Polymer/conductive filler composites are widely studied with a purpose to evaluate a composite suitability for gas sensing. Conductive filler within polymer matrix material forms electroconductive grid, where two filler particles are not geometrically connected. Therefore, chemoresistive polymer film gas sensitivity is based on charge tunneling through insolator layers between conductive nanostructures. When diffusion of analyte into a composite occurs, the isolator layer swells and conductive particle distance increases, in turn the composite electrical resistance also increases.

Here a method is presented which enables simultaneous mass, length and electrical resistance measurements. Data about a sample mass change give information about analyte diffusion rate and diffusion mechanism into the composite. Diffusion mechanism (Fickian, anomalous, Case II, Supercase II) evaluation is critically important for gas sensor material, because it says much about composite matrix material macromolecule mobility, that remarkably influence the sensor material response rate to the presence of gas. A sample length and electrical resistance evaluation give data about existing electrical resistance increase mechanism (tunneling; tunneling + conductive channel destruction) and response long-term stability.

The developed method and homemade setup has been demonstrated for investigation of polyisoprene/multi wall carbon nanotubes (MWCNT) composites with varying MWCNT content.