Sensor response of carbon spheres/poly(ethylene oxide) composite to aliphatic alcohol vapors

Cesar A. Nieves, Anamaris Meléndez, Nicholas Pinto and Idalia Ramos*
Department of Physics and Electronics, University of Puerto Rico at Humacao, Humacao, PR 00792
*idalia.ramos@upr.edu

I. INTRODUCTION

Over the past two decades, the field of nanoscience and nanotechnology has focused on carbon based materials like carbon nanotubes [1] due to their promise to revolutionize the electronics industry. In this work, we present the fabrication of sensors using carbon spheres (CS) [2] and Poly(ethylene oxide) (PEO) to detect alcohol vapors such as methanol, ethanol and 1-propanol. The simple, rapid and cheap fabrication and complete exposure of the device to the ambient can provide high sensitivity, low power and low cost for chemical analysis in the detection of flammable and toxic gases.

II. EXPERIMENTAL

An aqueous solution of sucrose was transferred into an autoclave and heated at 200^{o}C for 4h, then allowed to cool down to room temperature. The resulting black precipitate was washed to remove all soluble byproducts, and dried at 70^{o}C. The as-prepared CS were thermally annealed at 800^{o}C for 1h in a tube furnace under a constant flow of N_2.

Sensors were prepared using a pre-patterning gold electrodes and CS/PEO. The current measurements were monitored as a function of time at a fixed voltage, while a constant flow of dry N_2 gas was passed through the gas chamber. The gas flow was then switched between the alcohol vapor and N_2.

III. RESULTS AND DISCUSSION

Figure 1 shows an SEM image of the carbon spheres. These spheres had a uniform shapes and diameters in the range of 125nm-10μm.

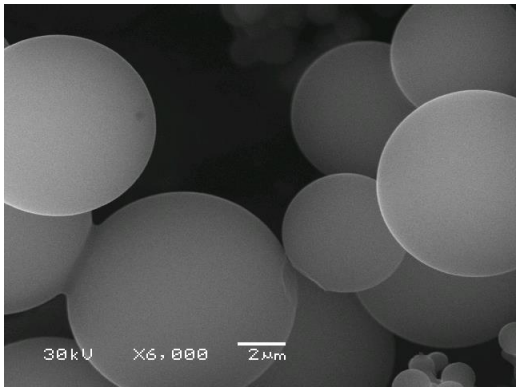

Figure 1. SEM image of the CS

Figure 2 shows the time dependence of the change in the sensor resistance for CS/PEO upon exposure to vapors of methanol and 1-propanol. Under the presence of the sensing alcohol gas, the sensor resistance increases while the control gas decrease the resistance [3]. We calculate the response and recovery time for the sensor to be 54s and 20s, respectively for methanol and 79s and 43s, respectively for 1-propanol.

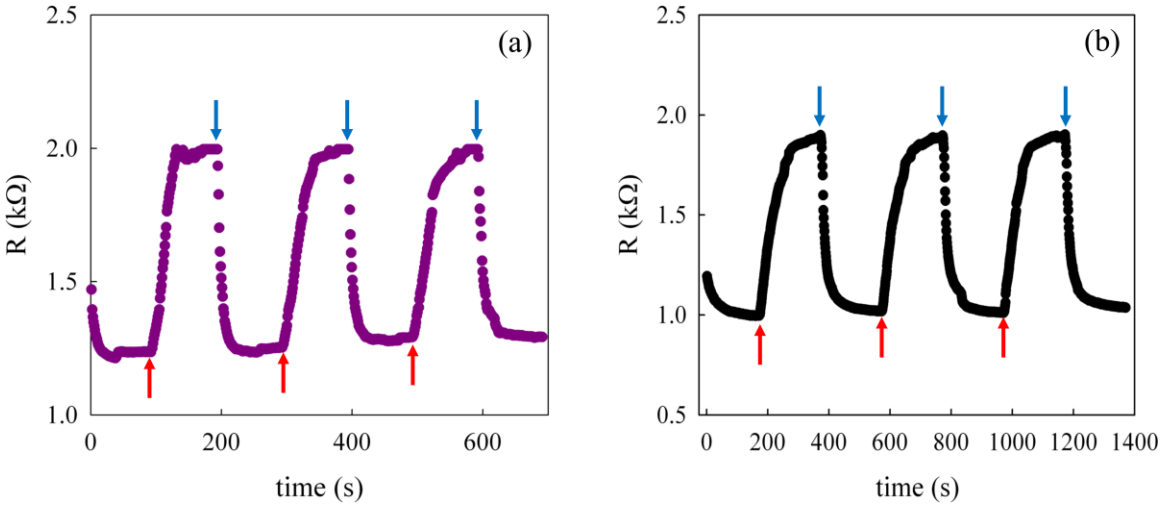

Figure 2. Resistance of CS/PEO for (a) methanol and (b) 1-propanol. The blue arrows indicate N_2 flow and the red arrows indicate the corresponding sensing alcohol gas flow.

IV. CONCLUSION

Sensors fabricated from CS/PEO were tested in the presence of various aliphatic alcohol vapors. The response times were longer for the larger molecules. Furthermore, the easy, rapid and cheap fabrication and complete exposure of the device to the ambient can provide high sensitivity, low power and low cost.

V. ACKNOWLEDGMENTS

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VI. REFERENCES

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