MORPHOLOGY AND ELECTRICAL PROPERTIES OF FLAME-FORMED CARBON NANOPARTICLES FOR CONDUCTOMETRIC SENSING APPLICATION

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Abstract

This research investigates flame synthesis as a cost-effective method for producing carbon nanoparticles film (CNPs) with a focus on their application in conductometric sensors. CNPs were obtained through a laminar premixed ethylene/air flame at atmospheric pressure stabilized on a water-cooled sintered bronze McKenna burner. The fuel mixture comprised ethylene and air with a C/O = 0.69 and a cold gas-stream velocity of 9 cm/s. Thermophoretic deposition was employed to fabricate the nanostructured CNPs film on the InterDigitated electrode (IDE) by self-assembling CNPs. The film was obtained by multiple insertions, using the pneumatic actuator, of the substrate in the flame: the residence time of each insertion was set to 100 ms. CNPs films were characterized using Atomic Force Microscopy (AFM) and Raman spectroscopy measurements to assess morphology, aggregation, and film structure. The electrical behavior of the IDE sensor was investigated by measuring the current-voltage characteristics as the amount of deposited material changes. As the number of insertions increases, the quantity of deposited material rises, resulting in an increased current. Moreover, both the sensitivity and the response rise with the increase in the amount of deposited material.

Acknowledgments

The work was founded by the Italian MUR through the PRIN2022-PNRR, project "THIN - Next Generation EU, Missione 4 - Componente 2 - Investimento 1.1. CUP B53D23025700001 and the PNRR project "Centro Nazionale HPC, Big Data e Quantum Computing ICSC" – Spoke 1, MUR: CN_00000013, CUP UNINA: E63C22000980007.