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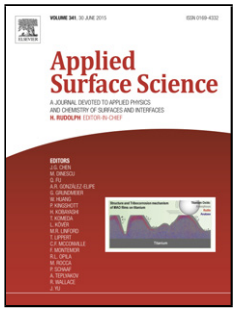

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Laser-induced forward transfer of carbon nanowalls for soft electrodes fabrication

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Abstract

Carbon nanowalls (CNW) are two-dimensional interconnected graphitic nanostructures that have a few µm in length and height, reaching typical thicknesses of a few tens of nm. We present results on such layers synthesized in a low pressure argon plasma jet, injected with acetylene and hydrogen, on transparent substrates (quartz) heated at 600 °C, without catalyst. Thermogravimetric analysis reveals that the CNW are stable up to 420°C in air, and Raman spectroscopy investigations highlight their graphene-like structure. Finally, using a pulsed *Nd:YAG* laser device (355nm, 50ps), we show that *2D*-arrays of CNW (pixels and lines) can be printed by laser-induced forward transfer (LIFT), preserving their architecture and structure. Electrical measurements on 1 µm thick CNW demonstrate typical values in the range of 357.5 – 358.4 Ohms for the samples grown on Au/Cr electrodes, and in the range of 450.1 – 474.7 Ohms for the LIFT printed lines (under positive, negative, and neutral polarization; 1kHz – 5MHz frequency range; 500 mV and 1 V, respectively). Their morphology is highlighted by means of optical and electronic microscopy. Such structures have potential applications as soft conductive lines, in sensor development and/or embedding purposes.

Keywords: *LIFT, CNW, graphene, vertical graphene, 2D-arrays, electrical properties, thermal analysis.*

1. Introduction

Graphene and graphene-based carbon allotropes (*i.e.* fullerenes, nanotubes, nanowalls, nanofibers) exhibit physical and chemical properties suitable for application in next-generation systems and devices. Graphene sheets attracted tremendous interest in radio frequency electronics because of their superior electrical properties, but also in other areas of physics, chemistry and biology, and have been regarded as "*a rapidly rising star on the horizon of materials science and condensed-matter physics*" [1]. Although graphene is still not highly used in commercial applications, there are now over 200 companies either producing graphene and/or derivatives, or developing applications. Devices such as transistors and radiofrequency receiver integrated circuits have already been demonstrated

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