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One-dimensional nanoelectrodes fabricated by plasma-assisted techniques

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The control of the material structure at the nanoscale has received a significant attention of researchers during the last decades to tailor and enhance their properties. A perfect example of the relevance of nanostructuration can be found for one-dimensional (1D) materials such as nanowires or nanotubes that present longitudinal sizes orders of magnitude larger than the cross-sectional.[1] The strong structural anisotropy of 1D-materials together to their nanometer size provide them with new and exciting properties that have opened a wide range of applications such as optics, sensing or electronics. Particularly important are the electronic applications, since this 1D structuration requires the implementation of rationally designed conductive electrodes that reduce electronic losses through the pathway along the mayor axis of the nanostructure.[2]

This work presents an evolved methodology[3] for the synthesis of supported conducting nanotubes (NTs). Concretely, we show the formation of Indium Tin Oxide and Copper NTsvdeposited by magnetron sputtering on organic nanowires acting as easily removable 1D template.[3] Combining experiments and Monte Carlo modelling, we control the thickness, porosity and microstructure of the walls and NTs density and length, paving the way towards the development of 1D nanoelectrodes under design. We show the optical and electrical properties of the NTs making a special effort in the elucidation of individual conductivity by assembling single-wire nanodevices and measuring them in a 4-probe platform installed in a SEM.

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