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Growth of vertically aligned carbon nanotubes on aluminum foils

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Forests of vertically aligned carbon nanotubes (VACNTs) are attractive nanomaterials because of their unique structural, electrical and thermal properties. However, many applications require their growth on metallic substrates. Catalytic chemical vapor deposition (CCVD) is the best method to grow them but the catalytic particles can diffuse rapidly into the metal subsurface and thus become inactive. In this communication, I will address this issue through the recent results obtained in our laboratory. I will show how it is possible to grow VACNT on carbon fibers [1], stainless steel and aluminum surfaces by a single-step process, namely the aerosol assisted CCVD, where the catalyst and carbon precursors are injected simultaneously [2].

In the case of aluminum, due to its low melting temperature, the synthesis of VACNT requires a significant reduction in the growth temperature as compared to conventional substrates [3]. Our results show that, with our single-step process, it is possible to obtain clean, long and dense VACNTs, with a growth rate at the best state of the art level for such a low temperature. A particular attention has been paid to the study of the CNT/Al interface. The results suggest the crucial role of the interface for an efficient and reproducible VACNT growth. Finally, I will show that the aerosol-assisted CCVD process can be scaled-up [4] to enable the fabrication of innovative ultracapacitors [5] based on VACNTs grown on aluminum foils.

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