Electrodes based on mixture of Graphene/Graphite/Carbon nanotubes obtained by a new dynamic spray-gun technique for supercapacitor related applications

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Abstract

The emergency of a new generation of supercapacitors based on new kind of nanomaterials has been pointed out by several important papers recently issued [1-3]. In this context the graphene/graphite and carbon nanotubes present extremely interesting properties. This contribution deals with the fabrication of supercapacitors using an original dynamic air-brush deposition technique [4]. The advantages of this technique are the compatibility with different kind of surfaces, the completely automatic process (Figure 1a and 1b), the uniformity of the material deposited and the versatility. Using this technique we have fabricated graphite/carbon nanotubes based electrodes (Fig.2 and 3) using different percentages of the two materials sprayed on the surface in order to study the influence of the different concentrations [5]. We are able to achieve flexible electrodes using graphite as collectors with capacitances from 20 to 50F/g with energy density of around 5 Wh/kg and power density around 10 kW/kg. Thickness can be modulated from some nms to tenths of µms. Our aim is to exploit the mixing of the two nanomaterials in order to enhance the potential electrode surface allowing to the ions to access all the potential surface achieving a sort of hierarchical assembly of the nanomaterials [3]. All the materials are put into solution using a very simple process (Figure 2). This technique can constitute a real breakthrough for the fabrication of new kind of electrodes using fine mixing of nanomaterials to improve supercapacitor performances using an industrially suitable process, moreover compatible with flexible surfaces. Our process is able to impact very quickly product for everyday life and can be considered relatively low-cost considering that it can be easily employed in a extremely reproducible way.

References

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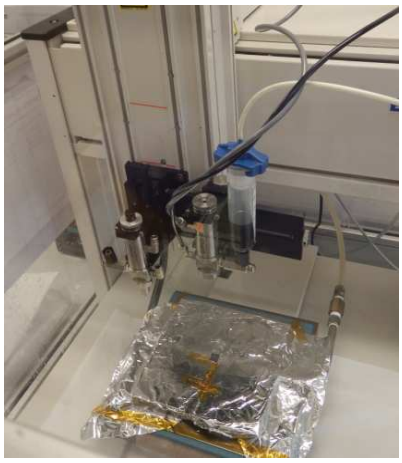
a 

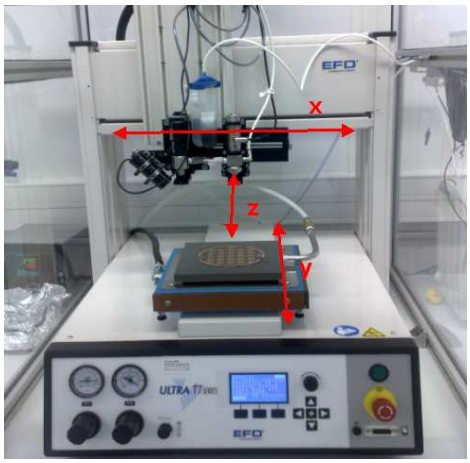
b 

Figure 1a and 1b : Spray-gun deposition machine

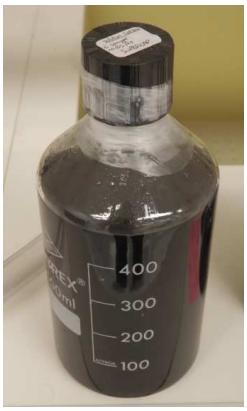


Figure 2: Carbon Nanotubes/Graphite solution

Figure 3 : Electrode achieved using spray-gun deposition method