Low temperature PECVD growth of vertically oriented graphene nanowalls for supercapacitor applications

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Abstract

Graphene nanowalls (GNWs) are networks of “graphitic” sheets that typically appear vertically oriented on a substrate. Low temperature synthesized and vertically oriented GNWs are attractive material with outstanding properties and great potential for various applications like supercapacitors, lithium-ion batteries, solar cells and sensors. For each application, high-quality GNWs should be grown on suitable substrate. For example, GNWs grown on Cu foil becomes an excellent electrode for supercapacitors, meanwhile, GNWs on dielectric (SiO_2) substrate could be used to fabricate gas or bio-sensors, also GNWs on semiconductor substrates could be used rather for potential application of solar cells. However, there are still few systematic studies of this promising material. In this study, we have used a RF remote plasma enhanced chemical vapor deposition (PECVD) method for growing the graphene nanowalls on top of Cu foil, c-Si substrate and silica substrate in the temperature range of 600-750ºC. The morphological and electrical properties of the obtained graphene nanowalls have been tailored by controlling the growth parameters, such as, plasma power, gas flow, temperature, pressure or cooling time. At present, there is no general agreement on an unified theory to unveil the GNW mechanism and to provide guidance for optimum growth condition using different plasma power and temperature. The present results of GNW show new evidences of its morphology, which have allow us to propose an interpretation of its growth mechanism.

References

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