

Capacitance of Few-Layer Graphene Electrodes Modified by Spontaneous Aryldiazonium Chemistry

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Abstract

There is an expectation that graphene will significantly change supercapacitor technology provided we can organize the 2D sheet architecture into practical assemblies. However, the energy storage capacity of graphene is low over a significant potential range compared to metals due to the quantum capacitance of the 1-atom thick sheet structure. This low capacitance, notably at the Dirac point, is due to the low density of states in graphene and is undesirable for practical supercapacitor applications. Defects and wrinkles introduced into the sheets are expected to increase the quantum capacitance in a useful way,[1] thus we may add these features into graphene sheets by incorporating chemical functionality, to boost energy storage capacity, and provide a method of controlling the assembly of each graphene sheet.

Here we present the results of chemically modifying few-layer graphene (3 – 7 layers) sheets using spontaneous grafting from aqueous aryldiazonium solutions.[2-4] Electrochemical, vibrational spectroscopy, and Kelvin probe microscopy results will be presented to illustrate that modification of basal plane graphene has a modest effect on the quantum capacitance but that chemical tethers provide a method of separating the graphene sheets for electrochemical capacitor applications.

References

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Figures

