North-East Research Conclave

Sustainable Science and Technology **Extended Abstract** **May 20-22, 2022**
Track: EG

Paper Based Pencil Drawn Multilayer Graphene-Polyaniline Nanofiber Electrodes for All Solid-State Symmetric Supercapacitors with Enhanced Cyclic Stabilities

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The advancement of portable devices possessing various applications has turned the attention of researchers towards the urgent development of flexible energy storage devices such as flexible supercapacitors and batteries [1-3]. Among these devices flexible supercapacitor has primary importance as it acts as a bridge in the gap between traditional capacitors and batteries [4]. In this work graphitic layer of carbon has been deposited on the surface of cellulose paper by simple pencil drawing approach. The edges of exfoliated multilayer graphene sheets formed during pencil drawing on the rough paper surface causes the enhancement of electrochemical capacitance. One step chemical polymerization technique has been adopted to fabricate polyaniline nanofibers on hydrophobic pencil drawn graphitic layer on the cellulose paper. These polyaniline coated pencil drawn paper electrodes were used to fabricate all-solid-state symmetric supercpapcitors with superior performance in comparison to similar pencil drawn paper electrodes without polyaniline. All-solid-state symmetric supercapacitor with paper based multilayer graphene-polyaniline nanofiber electrodes exhibits specific capacitance of 28.37 F g^{-1} , areal capacitance of 93.64 mF cm^{-2} , energy density of 8.32 μW h cm^{-2} , and power density of 39.97 μW cm^{-2} . It also shows excellent cyclic stability with initial increment to a maximum value and then decrease to 91.5 % of the maximum value after 5000 cycles. It is interesting to note that it retains 134.28 % of initial areal capacitance after 5000 cycles [5].

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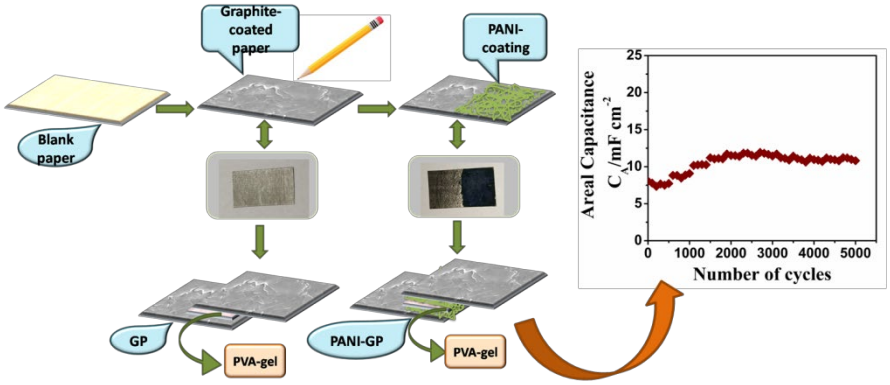

Figure 1 Graphical abstract

Table 1 Comparison with previously reported flexible solid-state-supercapacitors based on PANI

Material	Method	Electrolyte	Capacitance, C_A	Stability	Ref.
Graphene/polyaniline woven fabric	Electrochemical	PVA/ H_3PO_4	23 mF cm^{-2}	100 % after 2000 cycles	Nanoscale 7 (2015) 7318
Graphene/polyaniline composite	Chemical	PVA/ H_2SO_4	3.31 mF cm^{-2}	85.4 % after 10,000 cycles	Nano Energy 16 (2015) 470
Pencil-drawing graphite/polyaniline networks	Electrochemical	PVA/ H_2SO_4	355.6 mF cm^{-2}	83% after 1000 cycles	Nano Energy 2 (2013) 1071
Graphene/polyaniline paper	Electrochemical	PVA/ H_2SO_4	123 mF cm^{-2}	74.8 % after 500 bending	Energy Chem. 32 (2018) 166
Graphene-Polyaniline Nanofiber	Chemical	PVA/ H_2SO_4	93.64 mF cm^{-2} and 28.37 F g^{-1}	134.28 % after 5000 cycles	Present work