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# Facile Wick and Oil Flame Synthesis of High-Quality Hydrophilic Carbon Nano Onions for Flexible Binder-Free Supercapacitor

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**Abstract :** Carbon nano-onions (CNOs) are the spherical graphitic nanostructures composed of concentric shells of graphitic carbon can be hypothesized as the intermediate state between fullerenes and graphite. These are very important members in fullerene family also known as the multi-shelled fullerenes can be envisioned as promising supercapacitor electrode with high energy & power density as they provide easy access to ions at electrode-electrolyte interface due to their curvature. There is still very sparse report concerning on CNOs as electrode despite having an excellent electrodechemical performance record due to their unavailability and lack of convenient methods for their high yield preparation and purification. Keeping all these current pressing issues in mind, we present a facile scalable and straightforward flame synthesis method of pure and highly dispersible CNOs without contaminated by any other forms of carbon; hence, a post processing purification procedure is not necessary. To the best of our knowledge, this is the very first time; we developed an extremely simple, light weight, novel inexpensive, flexible free standing pristine CNOs electrode without using any binder element. Locally available daily used cotton wipe has been used for fabrication of such an ideal electrode by 'dipping and drying' process providing outstanding stretchability and mechanical flexibility with strong adhesion between CNOs and porous wipe. The specific capacitance 102 F/g, energy density 3.5 Wh/kg and power density 1224 W/kg at 20 mV/s scan rate are the highest values that ever recorded and reported so far in symmetrical two electrode cell configuration with 1M Na2SO4 electrolyte; indicating a very good synthesis conditions employed with optimum pore size in agreement with electrolyte ion size. This free standing CNOs electrode also showed an excellent cyclic performance and stability retaining 95% original capacity after 5000 charge –discharge cycles. Furthermore, this unique method not only affords binder free - freestanding electrode but also provide a general way of fabricating such multifunctional promising CNOs based nanocomposites for their potential device applications in flexible solar cells and lithium-ion batteries.

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