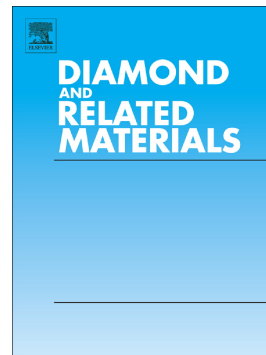


Accepted Manuscript

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PII: S0925-9635(17)30088-2
DOI: doi: [10.1016/j.diamond.2017.04.004](https://doi.org/10.1016/j.diamond.2017.04.004)
Reference: DIAMAT 6855
To appear in: *Diamond & Related Materials*
Received date: 20 February 2017
Revised date: 30 March 2017
Accepted date: 2 April 2017

Please cite this article as: Emmanuel Scorsone, Nouha Gattout, Lionel Rousseau, Gaelle Lissorgues , Porous diamond pouch cell supercapacitors. The address for the corresponding author was captured as affiliation for all authors. Please check if appropriate. Diamat(2017), doi: [10.1016/j.diamond.2017.04.004](https://doi.org/10.1016/j.diamond.2017.04.004)

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Porous diamond pouch cell supercapacitors

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Abstract

Supercapacitors are promising energy storage devices because of fast charge and discharge capacity, long lifetime and high power sources when compared to conventional batteries. Most carbon based supercapacitors nowadays use organic or ionic liquid based electrolytes in order to benefit from the large potential window in those solvents thus enabling more energy storage. However the devices suffer from low ionic mobility in such electrolytes, and also from economical, safety and environmental concerns associated with the use of organic solvents. Boron doped diamond (BDD) features a wide potential window in aqueous electrolytes and high stability toward oxidation in acidic or alkaline media, and therefore offers the possibility for BDD electrodes supercapacitor to operate in water. Here highly porous diamond electrodes fabricated by microwave plasma chemical vapor deposition of BDD over a conductive polypyrrole template with high double layer capacitance around 3 mF.cm⁻² were mounted in symmetrical pouch cell supercapacitor using either 1M H₂SO₄ or 1M TEABF₄ in propylene carbonate electrolytes. The performances of both devices were investigated. Energy and power values close to 1 μWh.cm⁻² and 700 μW.cm⁻² were recorded in water, thus surpassing by almost one order of magnitude the energy storage performances of the device using organic electrolyte.

1. Introduction

The beginning of the 21st century has seen a radical change in our way of living with the arrival of multifunction portable electronic devices including smartphones, tablets, etc. In such mobile equipment, wireless communication, touch pads or embedded sensors are functions that all contribute to the need for both compact and efficient energy storage. Nowadays this is achieved mostly by thin film technologies based rechargeable micro-

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