



## Heteroatom Doped Porous Carbons for Clean Energy Applications

Activated carbons are an emerging class of porous materials which are extremely versatile in their applications- gas storage/ separation sorbents, oxygen reduction reaction catalysts, and supercapacitor electrodes. Activated carbons feature lightweight, thermal, chemical and physical stability as well as adjustable textural properties. Doping of non-carbon elements into a heteroatom structure to alter specific properties allows fine-tuning of material properties. The most well-established dopant is nitrogen as it induces basicity and charge delocalization into the carbon structure to enhance gas sorption and electrochemical performances. However, a method of incorporating nitrogen into the carbon matrix which is efficient, facile and cost effective has yet to be established.

### The technology

By using benzimidazole as an inexpensive and commercially available single-source for carbon and nitrogen, inventors produced different series of heteroatom-doped porous carbons through a single-step, solvent-free, reproducible and scalable process. A typical synthetic method consists of solid-state mixing of two commercially available substances, a nitrogen-rich monomer and a stabilizer/activator, followed by a subsequent heat treatment of powdery mixture. Formation of stable salt, char development and porosity generation take place at different stages of a single-step reaction. The materials produced show exceptionally high CO<sub>2</sub> uptake at low pressures as well as high electrochemical capacitance, which makes them very promising for carbon dioxide capture and sequestration, and energy storage applications.

### Benefits

- » High CO<sub>2</sub> uptake at low pressures
- » Single step fabrication
- » Reliable reproducibility and scalability
- » Cost and energy efficiency
- » Solvent free reaction

### Applications

- » CO<sub>2</sub> capture and separation
- » Fuel cells and supercapacitors
- » Natural gas storage
- » Metal free catalysts

#### Patent status:

Patent issued: U.S. rights are available.  
16/098,716

#### License status:

This technology is available for licensing to industry for further development and commercialization.

#### Category:

Engineering and Physical Science

#### VCU Tech #:

15-094F

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