Contribution ID: **120** Type: **Oral Presentation**

<u>Analysis and optimization of the pore structure development in activated carbon nanostructures</u>

Friday, 7 July 2017 11:50 (20 minutes)

The formation mechanism of the porous framework in nanostructured carbons is important in a wide variety of applications such as in supercapacitors, gas storage, adsorbents and catalyst supports etc. especially in the production of activated carbons which are now one of the most common, cheap and efficient materials adopted by researchers for these applications. The accessibility to the pore sites by electrolyte ions and gases are highly determined by the precise synthesis techniques adopted for these materials. As such, there is an important distinction between porosity that is connected to the exterior of the material surface, and porosity that is effectively inaccessible to ion/fluid transport from the interior. These can be clearly distinguished using small-angle neutron scattering contrast matching (SANS-CM) technique by suppressing the accessible pores whilst filling them up with a material with the same scattering density, such as toluene.
In this study, activated carbon (AC) was produced from renewable biomass waste using a chemical vapour deposition (CVD) technique via a pre-hydrothermal conversion step with optimization of key growth parameters. The textural, structural and morphological features were investigated by the Brunauer-Emmett-Teller (BET) technique, X-ray diffraction (XRD), X-ray photoelectron spectroscopy (XPS), and Scanning/Transmission electron microscopy (SEM/TEM) characterization. Finally the quantification of the accessible pores to optimize the surface area of the materials will be evaluated using SANS-CM.
The results analysed from this work would aid in the production of efficient and stable porous materials, from renewable waste sources, suitable for electrochemical and gas sensing applications.

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PhD

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Session Classification: Applied Physics

Track Classification: Track F - Applied Physics