

## **Abstracts**

# **Carbon and Industrial Applications** **16<sup>th</sup> April 2010**



**Hosted by British American Tobacco, Southampton**

### **Mesoporous Carbon Beads – Production, Properties and Applications**

*Prof S. R. Tennison, MAST Carbon International Ltd*

It is recognised that there is a significant potential for microporous-mesoporous carbon materials in a wide range of applications. However in general this kind of pore structure can only be achieved by severe chemical or physical activation that leads to the production of either fine powders or granular/extrudate materials with poor physical strength and attrition resistance. This severely limits the areas where such materials can be used. By contrast, the solvent pore forming route developed by MAST allows the production of precisely controlled binary pore structures in carbon beads with high physical strength and excellent attrition resistance. The production and use of these materials in a range of applications encompassing catalysis, adsorption, biomedical and electrochemistry will be discussed.

### **Applications of Surface Enhanced Activated Carbon from Renewable Resources in Drinking Water**

*Dr S. Ragan\*, M. Downs\*, J. Knepper\* and W. P. Freeman\*\**

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The Taste and Odour (T&O) associated with a drinking water is one of the major factors governing its acceptability to consumers. Two common causes of taste and odour (T&O) issues are chlorine-based chemicals used for disinfection and dissolved H<sub>2</sub>S found in groundwater sources, e.g. wells. Activated carbon is commonly applied to the mitigation of T&O issues associated with chlorine but it is much less efficient when applied to alternative disinfectants such as monochloramine. H<sub>2</sub>S too is not readily treatable with standard activated carbons products. Recently specialized granular activated carbons have emerged with novel surface chemistry offering improved monochloramine and H<sub>2</sub>S removal efficiencies but these are mainly manufactured from non-renewable, coal-based resources. Coconut shell based activated carbon is a renewable resource being a by-product from the commercial operation of coconut plantations. However, standard coconut based products exhibit only a limited capacity for the removal of monochloramine or H<sub>2</sub>S. This paper details the relative efficiency of commercial activated carbons in the removal of monochloramine and H<sub>2</sub>S from water and describes the improved performance exhibited by novel, renewable resource based, coconut activated carbons with enhanced surface chemistry for the removal of T&O contaminants.

## **Activated carbon for military respiratory protection - past, present and future**

*Mr M. Smith, dstl*

The use of chemical warfare in the First World War rapidly led to the adoption of activated carbon filters to provide the military with protection against toxic gases and vapours. It was soon realised that the precursor had a significant influence on protection levels, and that addition of extra "impregnants" could offer a means of improving performance against specific chemicals of concern. Continuation of this process eventually led to the development of "Whetlerite" type carbons, derivatives of which are used in many current military filters. These are typically based on a coal precursor, activated to give a BET surface area in excess  $1000 \text{ m}^2 \cdot \text{g}^{-1}$ , and with a range of impregnants added to remove various species through chemical reaction. The hazards posed by toxic industrial chemicals, as illustrated by the use of chlorine in Iraq in 2007, coupled with a desire to reduce the burden (e.g. physiological, logistic etc) on the user, means that there remains a need for effective, broad spectrum adsorbents and increased understanding of the underlying removal mechanisms.

## **Recent Development of Activated Carbons in China and Novel Structured Porous Carbon**

*Prof A. Lu, Dalian University of Technology*

Porous carbon materials form a large and important class of porous solids, which have been widely applied for technological applications in adsorption of gases, vapors and liquids, purification, catalysis, energy storage devices, etc. In this talk, firstly, a general introduction of activated carbons in China will be given, including the factory distribution in China, manufacturing, annual turnover and applications of activated carbons. In the second part, a brief introduction concerning my group research activity on synthesis, characterization and application of novel porous carbon materials. Using sol-gel, nanocasting approach and soft-templating method, various porous carbon materials with disordered or ordered mesostructures, amorphous or graphitized nanostructures can be prepared. Their applications in ammonia decomposition, alcohol oxidation and  $\text{CO}_2$  capture will be briefly discussed.

## **Nanoporous Carbon Adsorbents**

*Prof K. Sing, Emeritus Prof Brunel University*

In the first part of this review a brief description will be given of various nanoporous carbons now available with an indication of their different adsorptive properties. Activated carbons are of great industrial importance, but most commercial grades are highly microporous and exhibit pronounced structural and surface heterogeneity. Recent progress has been made in the development of novel carbons with more uniform micropore or mesopore structures. The second part of the talk will deal with the interpretation of physisorption data. The application of density functional theory will be discussed in relation to the evaluation of the nanopore size distribution of carbon adsorbents.

## **Activated Carbon for the Adsorption of Vapour Phase Cigarette Smoke Toxicants**

*Dr P. Branton, British American Tobacco*

Cigarette smoke is a complex non-equilibrium mixture of chemicals (predominantly air) with thousands of compounds being generated from the incomplete combustion of tobacco. These are distributed between the gas phase and the particles which constitute the smoke aerosol (the particulate phase). Activated carbon is a good filter material for the adsorption of many smoke vapour phase compounds despite the challenging environment (complex mixture of chemicals, short contact times, filter format constraints etc). The carbon characteristics are important to maximise the adsorption, with a combination of macro/mesopores and micropores giving the greatest reductions. A description of cigarette smoke will be presented together with experimental data showing how various carbons perform in a cigarette filter. Emphasis will be placed on the adsorption kinetics and the concept of carbon ageing and the effects of water within the smoke will be discussed.