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Waste-derived carbon: structure, properties and applications

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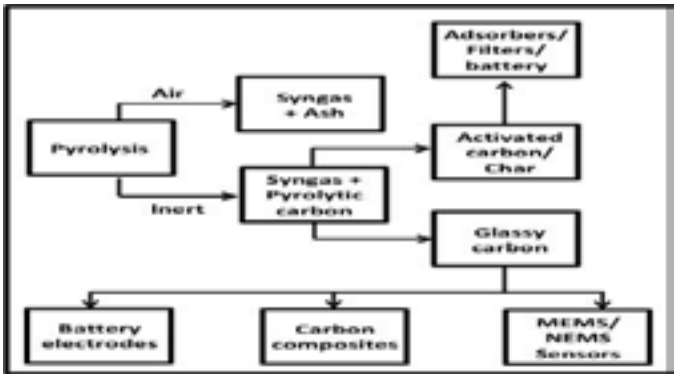
Pyrolysis or controlled heating of biodegradable and non-biodegradable polymers is an emerging technique for their safe decomposition and possible recycle. The mixture of volatile products resulting from pyrolysis is typically collected as the 'syngas', which is further separated by distillation into gaseous products to be used as fuels and precursors for the synthesis of various high molecular weight organic compounds. However, one major challenge associated with waste polymer pyrolysis is the handling of the residual solid byproducts, often designated as 'ash'. In our group we develop novel pathways to pyrolyze polymers such that the solid residues are useable forms of elemental carbon rather than ashes. Depending on the surface properties and the extent of crystallinity these carbon materials are further classified as glassy or activated. While activated carbon, often obtained from cellulosic materials such as papers waste, is employed in various industry-scale adsorber and filtration applications; glassy carbon is extensively used in miniaturized devices such as micro/ nano electromechanical systems (MEMS/ NEMS), battery and supercapacitor anodes, sensors and cell culture scaffolds owing to the fact that it can be derived from lithographically patterned polymers. This talk will be focused on various aspects of pyrolytic carbons including (i) the structure-property relationship in pyrolytic carbons at bulk and nano-scale, (ii) influence of pyrolysis conditions on the microstructure of resulting carbon, (iii) characterization and classification of carbon obtained from polymers of different chemical classes, and (iv) unconventional applications of pyrolytic carbons. Pyrolysis efficiency, state-of-the-art characterization techniques such as in situ electron microscopy will also be touched upon.



Recent Publications

1. Erwin Fuhrer, Anne Bäcker, Stephanie Kraft, Friederike J. Gruhl, Matthias Kirsch, Neil MacKinnon, Jan G. Korvink, Swati Sharma. 3D Carbon Scaffolds for Neural Stem Cell Culture and Magnetic Resonance Imaging. Advanced Healthcare Materials, 2017, 1700915.
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5. Swati Sharma, Neil MacKinnon, Vlad Badilita, Sebastian Kiss, Lorenzo Bordonali, Jan Korvink. Carbon MEMS for Magnetic Resonance. In 'Carbon: The Next Silicon?', Momentum Press, LLC, New York USA, 2016.

Biography

Dr. Swati Sharma currently leads the Advanced Carbon Materials and Devices research group at the Institute of Microstructure Technology, Karlsruhe Institute of Technology, Germany. Her research is focused on pyrolysis optimization for polymers from different chemical classes for obtaining carbons with pre -defined properties. These carbon materials are then used for various applications ranging from miniaturized devices to the bulk manufacture of composites. She is involved in various international collaborative projects aimed at large-scale waste treatment, and has organized meetings and workshops to facilitate a common platform to scientists working on different aspects of waste disposal and treatment. Her interests include finding novel applications of pyrolytic carbon and efficient scale-up of this technology to make it commercially more profitable.

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