CONCEPT PAPER

for KIER International Cooperation project

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Title	Functionalised Biomass Materials for Advanced Energy Conversion and Storage Applications			
Description	Increasing energy demands and environment awareness have promoted extensive research on the development of alternative energy conversion and storage technologies with high efficiency and environmental friendliness. Among them, water splitting is very appealing, and is receiving more and more attention both from the point of view of energy storage (hydrogen evolution) and utilization (fuel cell application). The critical challenge of this renewable-energy technology is to expedite the oxygen evolution reaction (OER) because of its slow kinetics and large overpotential. Therefore, developing efficient electrocatalysts with high catalytic activities is of great importance for high-performance water splitting. The great challenge here is to find materials which can be manufactured cheaply, using "green" technology, and which work effectively and these represent the significant obstacles to be met if breakthroughs in this area of technology are to be seen. Based on recent pioneering work in our experiments, it has been demonstrated that biomass derived nanocarbon materials ideal for application in this area can be produced using a cheap scalable green technology based around plant pyrolysis. Furthermore in preliminary work, they have investigated new routes for materials doping using non-precious metals which is applicable to these materials. The aim of the project will therefore be to harness this collaborative expertise to produce scalable optimized "green" materials comprising composites between biomass-derived nanocarbons and non-precious metals to yield breakthrough materials for the oxygen evolution reaction. This will significantly enhance whole areas based around electrochemical energy storage and utilization within the arena of hydrogen, fuel cell and battery economies.			
Outcomes*	In a country such as the UK, around 25% of electricity is already generated by renewables such as solar and wind power with the fluxional behavior leading to massive demand for energy storage. The market for these storage devices is expected to exceed 30 billion dollars in the next 20 years, with 40 terawatt- hours of electricity having to be stored on a regular basis over a period of several months in a national economy typified by the UK. Storage as hydrogen gas is expected to be one of the main routes for this long term storage whereas fuel cell technology will also rise in importance for energy utilization. The project outlined above could provide the necessary breakthrough in the electrochemical technology needed to reach these goals and outstanding outcomes with creativity and efficiency.			