Fabrication and Validation of a Nano Engineered Glucose powered Biofuel Cell

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Exhaustion of fossil fuels and development of non-conventional sources of power are hot topics under discussion. Fuel cells are highly reliable candidates to curb this issue. They are electrochemical devices that convert chemical energy (fuel) into electricity. The skeletal system of a fuel cell consists of catalyst loaded electrodes; i.e an anode in which the fuel is supplied, cathode in which oxygen is supplied and an electrolyte membrane. The beauty of this device is that the protons and electrons are dissociated at the membrane. The protons travel through the membrane and forms the bi product at the other end; whereas the electrons are taken out as electricity at the electrodes. The fuel cells are classified into various types depending on the electrolyte utilized or the fuel supplied. Hereby we present a glucose fuel cell architecture, as displayed in Fig. 1, fabricated by assembling gold and silver nanoparticles as electrode catalysts that were synthesized and loaded on activated carbon cloth (electrodes). These metal nanostructures were fabricated and loaded using novel concepts of green chemistry.

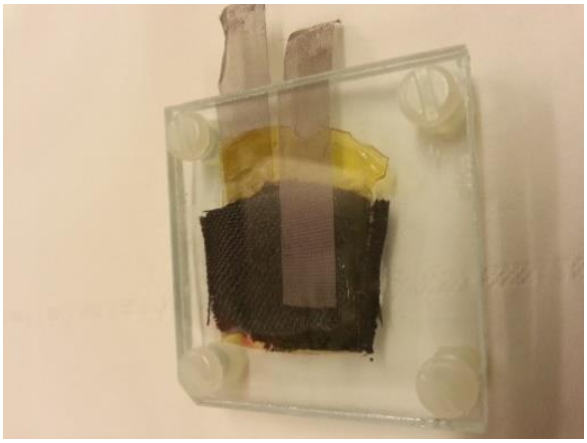

Fig. 1 The Glucose Fuel Cell (GFC) fabricated; including the catalyst loaded cathodic and anodic electrodes, PVA/PAA electrolytes, current collectors and the outer acrylic support and screws.

Polyvinyl Alcohol/Polyacrylic Acid (PVA/PAA) membranes were synthesized as electrolyte membrane. Scanning Electron Microscopy (SEM), Inductively Coupled Plasma (ICP), Ultra Violet Spectroscopy (UV-Vis), Thermal Gravimetric Analysis (TGA), Differential Scanning Calorimetry (DSC) characerizations have been performed for the evaluation of materials at various processing stages. Glucose has been used as the fuel source. The power output testing was carried out in glucose water utilizing biological glucose levels in human body. Apart from being environmental friendly power generators, glucose powered biofuel cells could power up embedded biosensors in near future.