Abstract Submitted
for the MAS17 Meeting of
The American Physical Society

Biofuel cells with pressure-immobilized enzymes on carbon nanotube sheets BIAO LENG, Materials Science Program, New Jersey Institute of Technology, LAILA AL-QARNI, ZAFAR IQBAL, Chemistry and Environmental Science, New Jersey Institute of Technology — Enzymatic biofuel cells (EBFCs) convert the chemical energy of biofuels into electrical energy by employing enzymes as catalysts. In contrast to hydrogen fuel cells, EBFCs have a simple membrane-free fuel cell design due to the high catalytic specificity of the enzymes, but the power densities (POD) obtained are much lower. Although initially the primary goal of research on EBFCs was to develop a sustainable power source that can be implanted in the human body to power bio-devices, other applications, such as the use of a flexible film or EBFC patch as a wearable power source, are emerging. The POD and lifetimes of early EBFCs were not promising due to the difficulty of transporting electrons from reactive sites to the electrodes and the tendency of enzymes to migrate away from the electrodes. To mitigate the issue of electron transport, direct electron transport via carbon nanotubes (CNTs) were proven to be effective. Here, CNT sheets immobilized with enzyme using pressure technique has been implemented to fabricate the electrodes. Agar gel with glucose was used as the electrolyte and a polymer enclosure was used for packaging. The POD and lifetime of these cells will be discussed. Similar or even higher POD (over 110 μW/cm^2) has been obtained compared with conventional EBFCs. We will also discuss initial ex-situ Raman measurements on bioelectrodes with a gold layer for surface enhancement in advance of performing in-situ and operando Raman spectroscopy in the EBFCs.

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Date submitted: 28 Sep 2017 Electronic form version 1.4