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Electrode Materials in Microbial Fuel Cells

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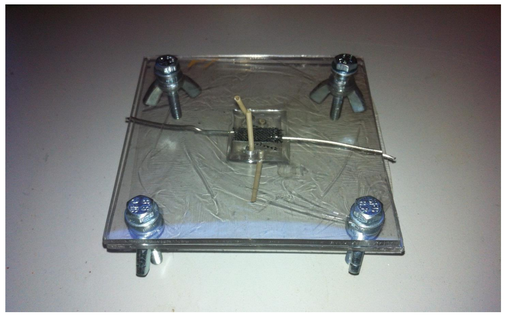
Introduction

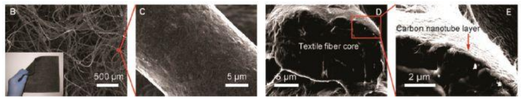
Microbial Fuel Cells (MFCs) are an example of bio renewable resources that we are now tapping into in order to power our world. They work by having microbes put into the anodic chamber where they are fed and give off electricity to the anode, this electricity then runs through the circuit and returns through the cathode and is oxidized and the electric flow is continued due to the Proton Exchange Membrane that separates the two chambers.



Microbial Fuel Cell Assembly

Materials

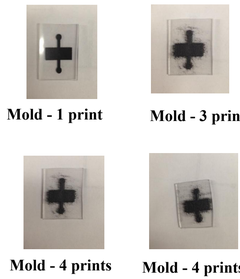
Materials that were researched for this project were Carbon Cloth, Carbon Paper and Carbon Nanotubes. There are several advantages that each offer but the Carbon Nanotubes have shown better results in other studies than the other two which are both about the same usually.



Carbon Nanotubes

Fuel Cell Fabrication

Fabrication of the fuel cell is done by printing several layers of ink onto thermoplastic and then placing this sample in the oven to shrink. When the mold has shrunken down it is cooled then put back into the oven to smooth the features. Then the mold is cooled again and a PDMS mold is made by using soft lithography.

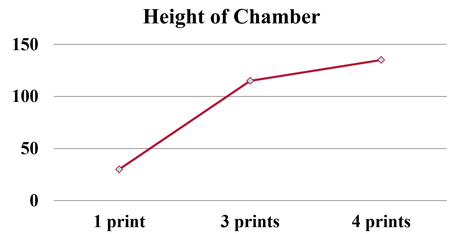


Mold - 1 print

Mold - 3 prints

Mold - 4 prints

Mold - 4 prints Post Heat



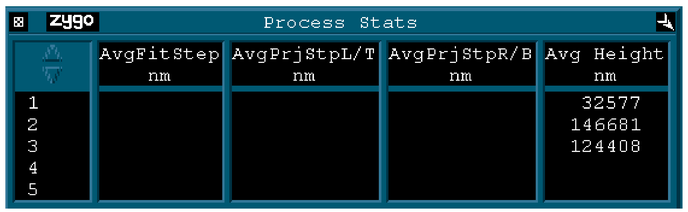
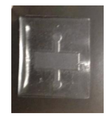


Table of height measurements (1) 1 print mold (2) 4 print mold (3) 3 print mold

PDMS Mold Fabrication

The goal of this part of the project is to fabricate a chamber for the Microbial Fuel Cell made of polydemethylsiloxane (PDMS). The chamber is about 100 µm deep 10 mm long and 4 mm wide. The PDMS mixture is poured on the surface of the metal wafers and left to sit until all the bubbles are out of it. Then the PDMS is baked for about 16 min at 100 C.



PDMS 3 prints

PDMS 4 prints

PDMS 4 prints Post heat

Future Work

Future work on this project will include synthesis of composite electrode materials and investigating how they affect the MFC efficiency. Also different strains of bacteria and microalgae will be explored as well as different combinations of strains. Finally, we will explore how altering the fluidics of the chambers affect the efficiency.

Acknowledgements

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