Enhancement of electrochemical performance of Bilirubin Oxidase modified gas diffusion Biocathode by porphyrin precursor

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***Preparation of BOx ink for complete fuel cell testing*:** 2 wt% MWNT ink solution was prepared by dissolving 4:1 ratio of water to ethanol (by weight) and added to 100mg MWNTs (10-20nm). The prepared mixture was subjected to sonication for 1hour in ice bath vortexing every 20min interval time. 15µL of 300mM Di-Carb (in DMSO) and 525µL of stock solution of 2% MWNT ink were mixed, vortexed and incubated for 1hour. This was followed by addition of 15µL of 300mM PBSE (in DMSO) and 62µL of water and left for incubation for 1hour. To this, BOx (73mg) was weighed and added to MWNT ink and incubated again for 1hour at room temperature. Later 617µL of the ink was then deposited on the prewetted buckeye paper of air breathing cathode (7.3cm^2) premodified with hematin. A 10mM hematin solution was prepared by mixing 10mM hemin (prepared in DMSO) into 100mM sodium hydroxide (NaOH) solution. The as prepared solution was sonicated for 1hour and 761µL of the mixture was deposited onto the buckeye paper layer (2cm^2) of the pressed air breathing cathode. The electrodes were left to dry for 4hours at room temperature prior to BOx ink deposition. Following ink deposition, a chemical deposition of tetramethyl orthosilicate (TMOS) was performed by sealing cathodes in a

petri dish containing small caps filled with water and TMOS. The petri dish remained sealed for 5min before discarding the TMOS. Cathodes were then stored at 4°C overnight.

Cyclic voltammetry studies of Hematin modified air breathing cathodes.

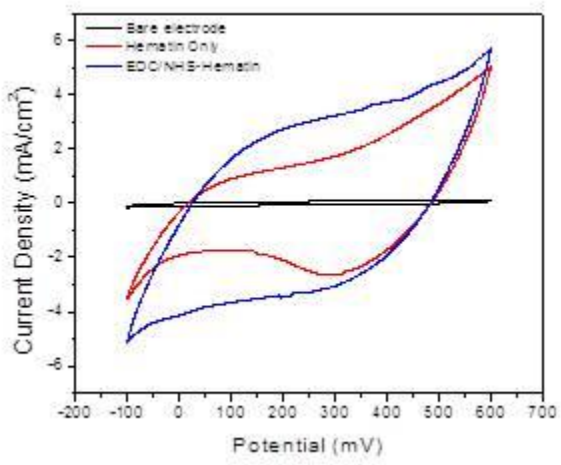

Figure 1: Representative CV curves for a bare (black), hematin (red), and a EDC/NHS-hematin (blue) modified air breathing cathode tested in 245 mM PBS buffer (scan rate of 250 mV/s).

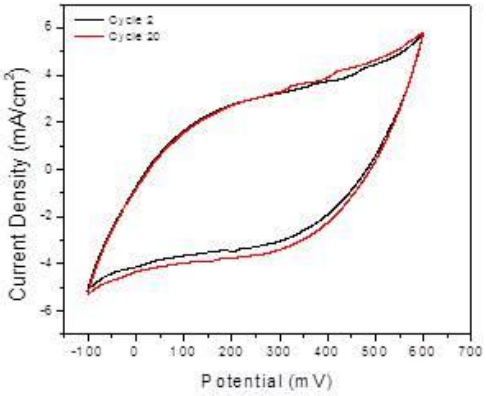

Figure 2: Representative CV curves comparing cycle 2 (black) and cycle 20 (red) of a EDC/NHS-hematin modified air breathing cathode tested in 245 mM PBS buffer. The following settings were used for the CV testing: a potential range of 600 to -100 mV, a total of 20 cycles, and a scan rate of 250 mV/s.

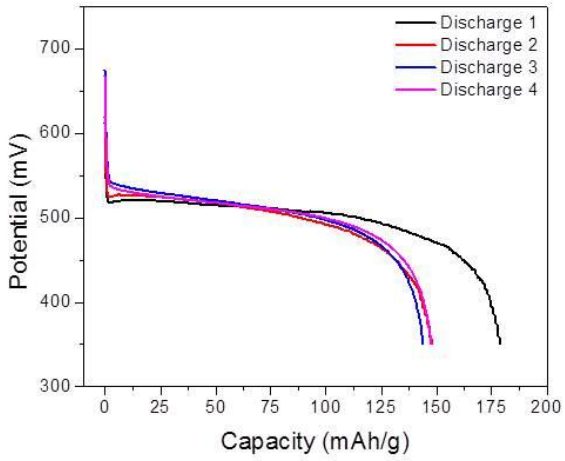

Figure 3: Representative discharge curves for a BOx/GDH fuel cell discharged consecutively 4 times under a constant load of 3.0 mA.