Supplementary Material (ESI) for Chemical Communications

A Novel Mediatorless Microbial Fuel Cell Based on Direct Biocatalysis of *Escherichia Coli*

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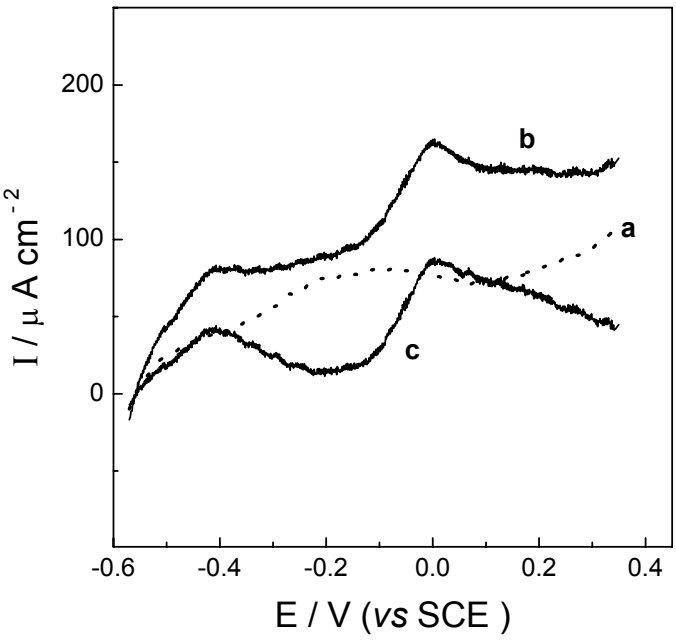
A. The details about the fabrication of fuel cell electrodes

To prepare the composite anode, certain amount of fine graphite particles (5μm in diameter) and PTFE emulsion were mixed thoroughly to form a paste, which was then pressed on a roller press to form an film of about 150μm. The optimized content of the PTFE in the composite anode was found to be around 20%(w/w). The cathode was constructed by hot-pressing a gas diffusion film onto a piece of PEM (Nafion 111, Dupot) with one side coated by 20 wt.% Pt/C catalysts (Pt loading: 0.2mg cm^{-2}). The anode chamber was a cylindrical cavity of 3cm in length and 1.8cm in diameter made from an organic glass rod. The geometric area of the anode contacted with the solution is 2.54 cm^2. The fuel cell was discharged at 33°C under constant-load mode by connecting the anode and cathode with a resistor(1.98KΩ). A PEM strip was used to connect the anode chamber and a phosphate buffer (100mM, pH 7) solution in which a saturated calomel electrode (SCE) is immersed. The anode potential can thus be measured. Combining the anode potential and the cell voltage gives the corresponding cathode potential.

B. The linear voltammetric curves



The current-potential curves obtained on a graphite-PTFE composite film electrode supported on glass carbon during the positive-going linear potential scan in (a) blank medium and (b) the culture of the electrochemical *E. coli* of generation II. The experiment was carried out at 33°C with potential scan rates of 10mV s^{-1}. The curve (c) is obtained by subtracting of curve (b) with curve (a).

In the blank medium, the current-potential curve shows a broad oxidation peak with very low current in the potential region from –0.35V to 0.0V, characterizing the oxidation of graphite in the buffer solution. This implies that the graphite has very poor catalytic activity toward the glucose oxidation. In the presence of the *E. coli*, however, evident increase in the oxidation current occurs accompanying the positive shift of potential, indicating that the *E. coli* can catalytically oxidize the glucose and transfer the electrons to the working electrode. The curve (c) should represent the current due to *E. coli* catalyzed oxidation of glucose. It can be seen that two separated oxidation peaks are seen on this curve.