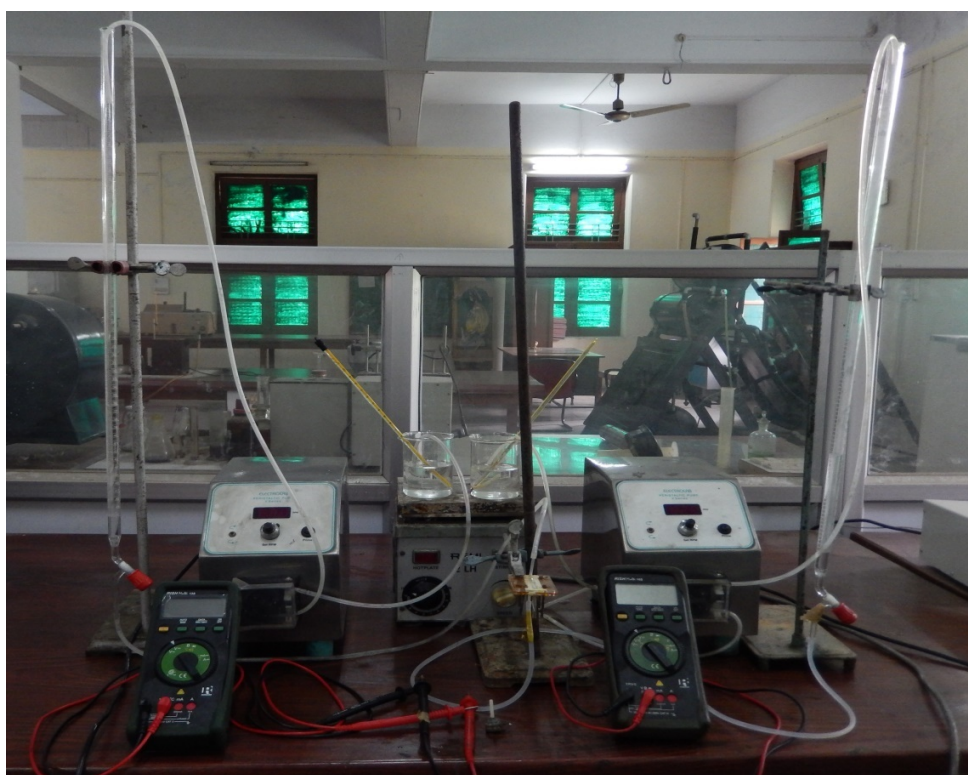


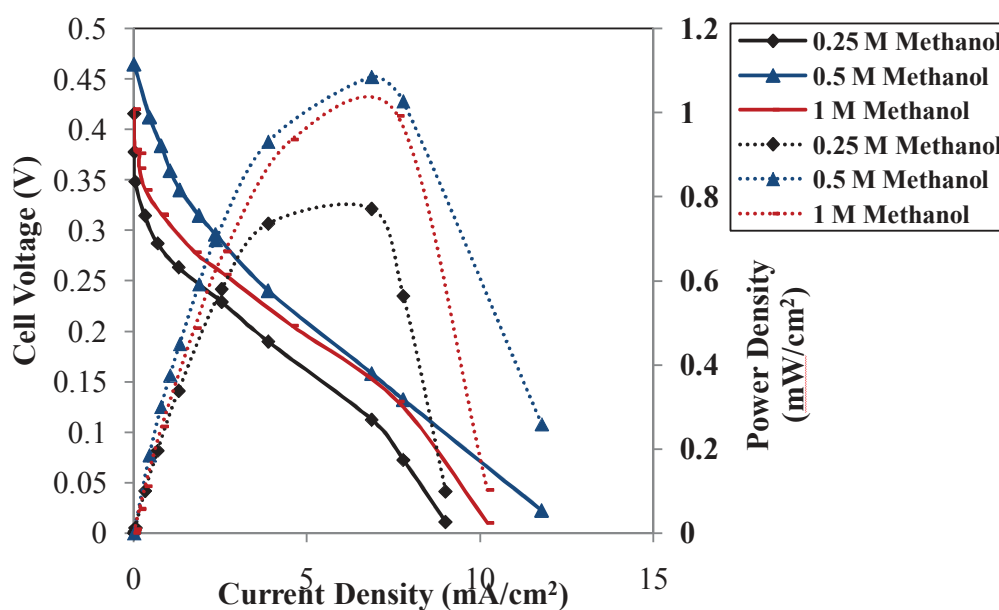
**APPENDIX A1****A1.a** Photograph of Air breathing Microfluidic Fuel Cell Setup**Figure A1.a** The photograph of Air breathing Microfluidic Fuel Cell Setup



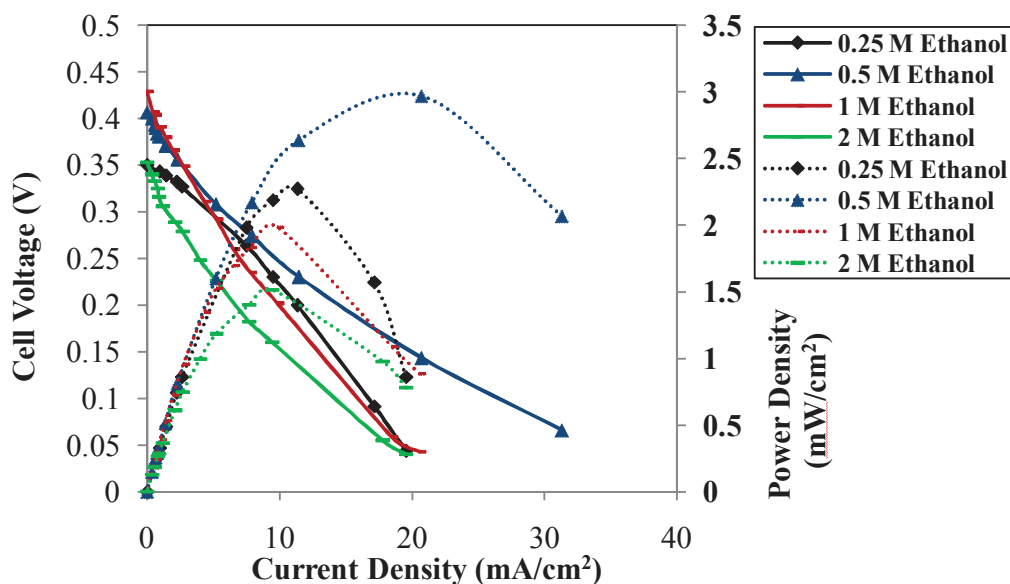
## APPENDIX A2

The IIT (BHU) laboratory made GDL was used for the anode and cathode fabrication for some experiments using methanol and ethanol as fuel. The experimental results (current density vs. cell voltage and current density vs. power density characteristics) are given below:

### A2.1 Effect of Fuel Concentration

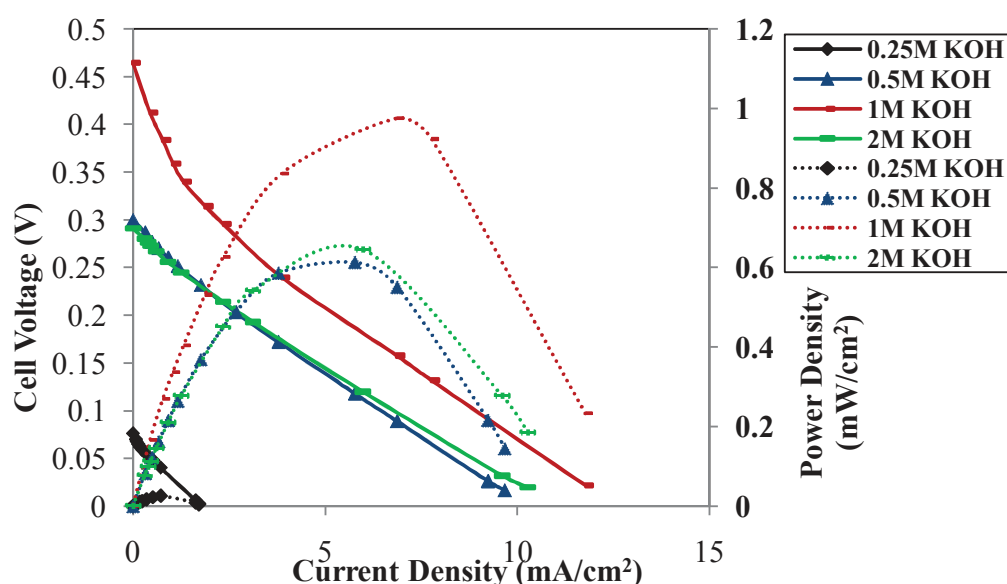


**Figure A2.1a** Current density vs. cell voltage and current density vs. power density curves for different concentration of methanol mixed with 1 M KOH as fuel using optimum concentration of electrolyte (1 M KOH) at cathode side and air as oxidant; Temperature 34 °C; Solid lines-polarization curves; Dotted lines-power density curves.

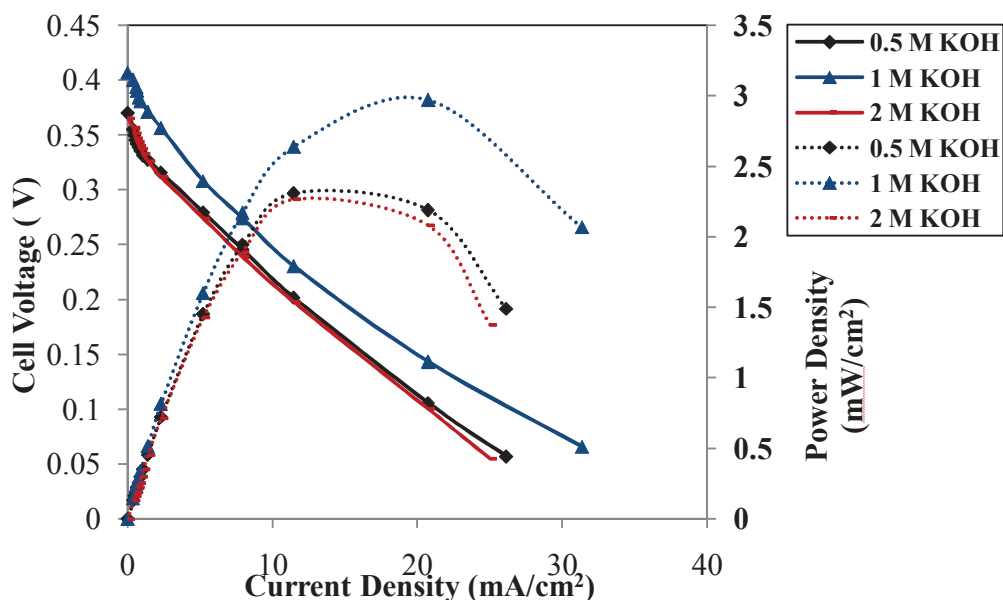


**Figure A2.1b** Current density vs. cell voltage and current density vs. power density curves for different concentration of ethanol mixed with 1 M KOH as fuel using optimum concentration of electrolyte (1 M KOH) at cathode side and air as oxidant; Temperature 34 °C; Solid lines-polarization curves; Dotted lines-power density curves.

## A2.2 Effect of electrolyte concentration at anode side

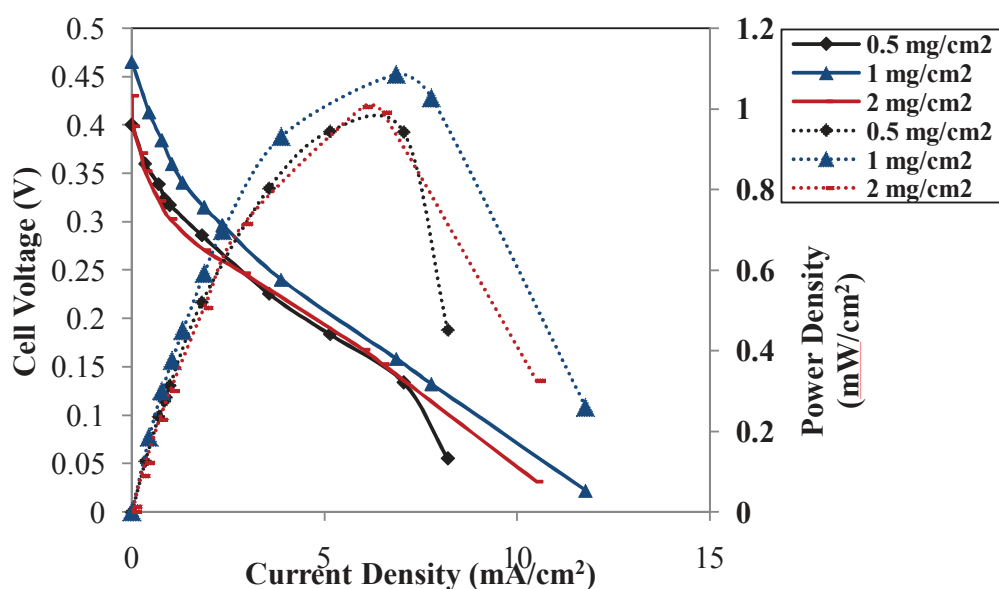


**Figure A2.2a** Current density vs. cell voltage and current density vs. power density curves for 0.5 M methanol mixed with different concentration of KOH at anode and fixed cathode electrolyte of 1 M KOH and air as an oxidant; Temperature 34 °C; Solid lines-polarization curves; Dotted lines-power density curves.

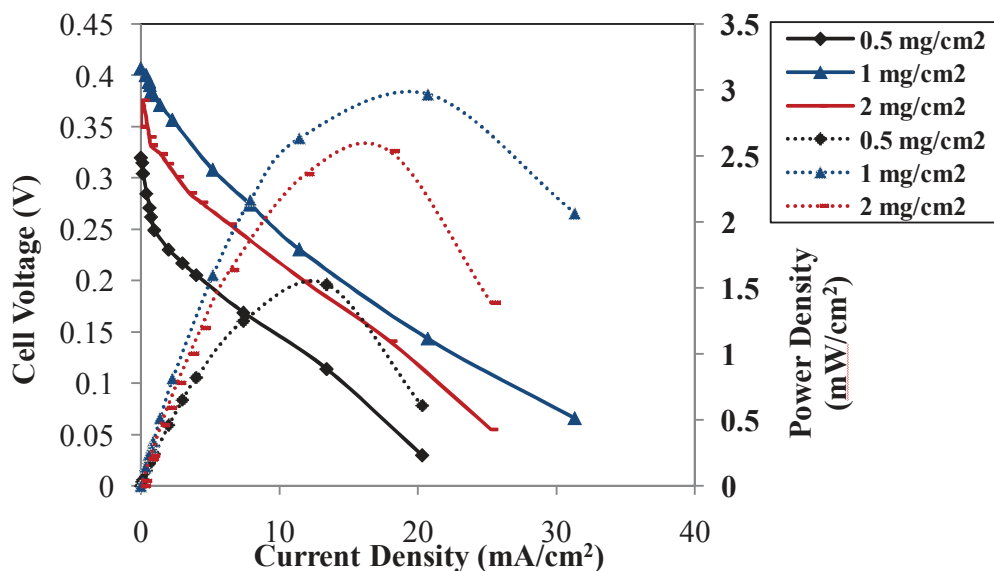


**Figure A2.2b** Current density vs. cell voltage and current density vs. power density curves for 0.5 M ethanol mixed with different concentration of KOH at anode and fixed cathode electrolyte of 1 M KOH and air as an oxidant; Temperature 34 °C; Solid lines-polarization curves; Dotted lines-power density curves.

### A2.3 Effect of Electrocatalyst Loading at Anode

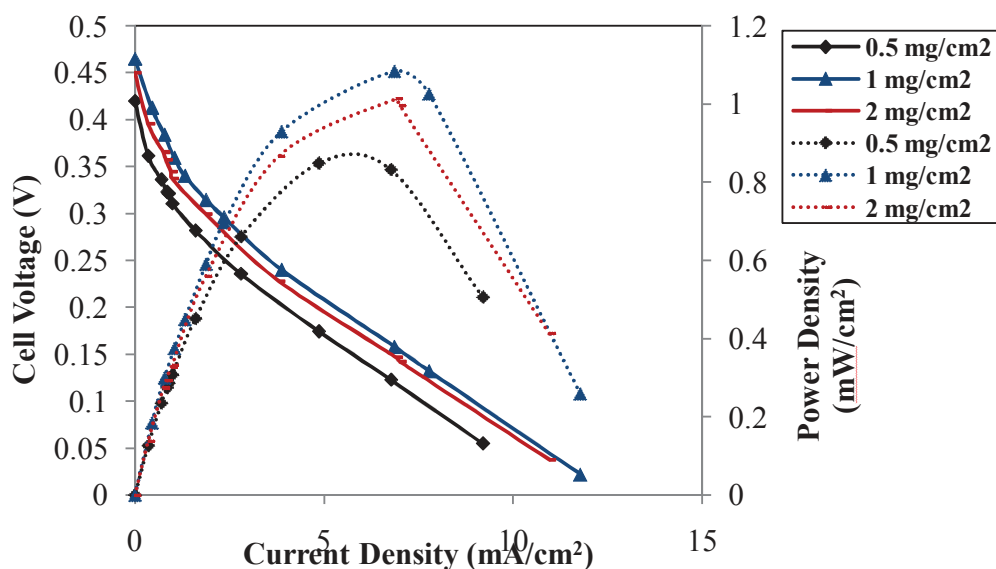


**Figure A2.3a** Current density vs. cell voltage and current density vs. power density curves for 0.5 M methanol mixed with 1 M KOH as electrolyte using different anode electrocatalyst loading of Pt-Ru/C<sub>HSA</sub> and cathode at fixed loading of 1 mg/cm<sup>2</sup> Pt/C<sub>HSA</sub>; Temperature 34 °C; Solid lines-polarization curves; Dotted lines-power density curves.

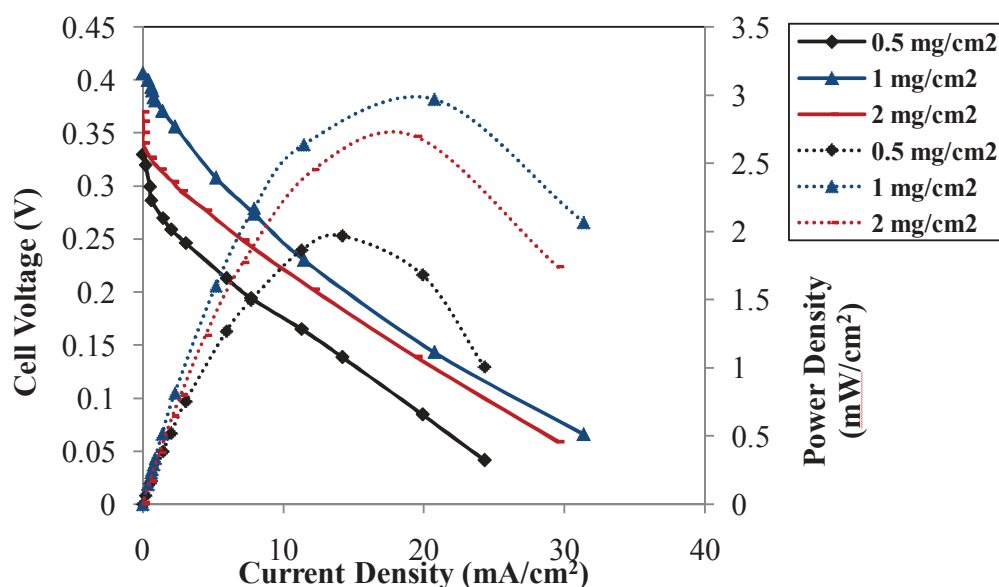


**Figure A2.3b** Current density vs. cell voltage and current density vs. power density curves for 0.5 M ethanol mixed with 1 M KOH as electrolyte using different anode electrocatalyst loading of Pt-Ru/C<sub>HSA</sub> and cathode at fixed loading of 1 mg/cm<sup>2</sup> Pt/C<sub>HSA</sub>; Temperature 34 °C; Solid lines-polarization curves; Dotted lines-power density curves.

#### A2.4 Effect of Electrocatalyst Loading at Cathode

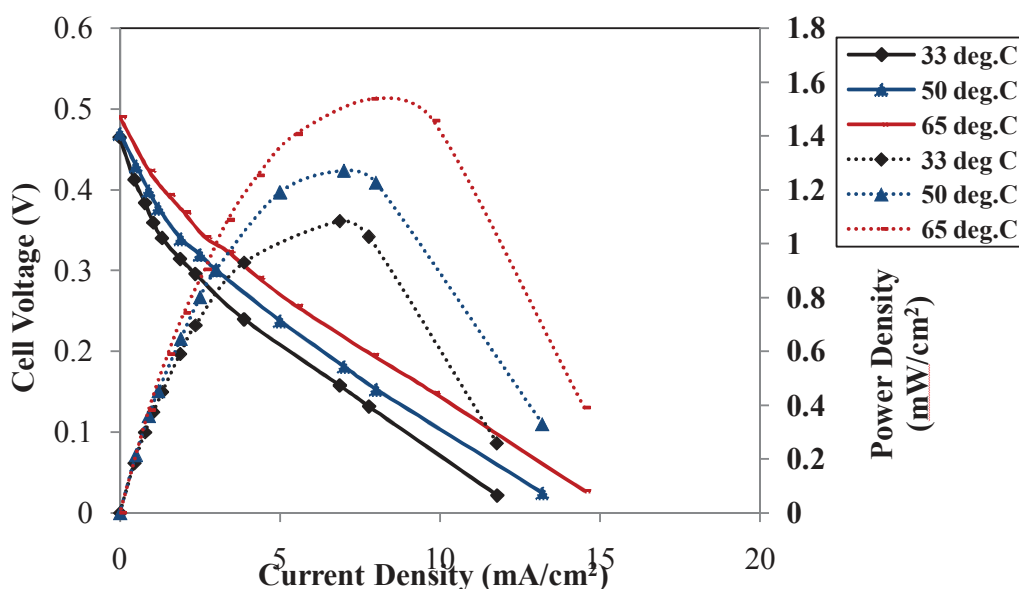


**Figure A2.4a** Current density vs. cell voltage and current density vs. power density curves for 0.5 M methanol mixed with 1 M KOH as electrolyte at different cathode electrocatalyst loading of Pt/C<sub>HSA</sub> and anode at fixed loading of 1 mg/cm<sup>2</sup> Pt-Ru/C<sub>HSA</sub>; Temperature 34 °C; Solid lines-polarization curves; Dotted lines-power density curves.

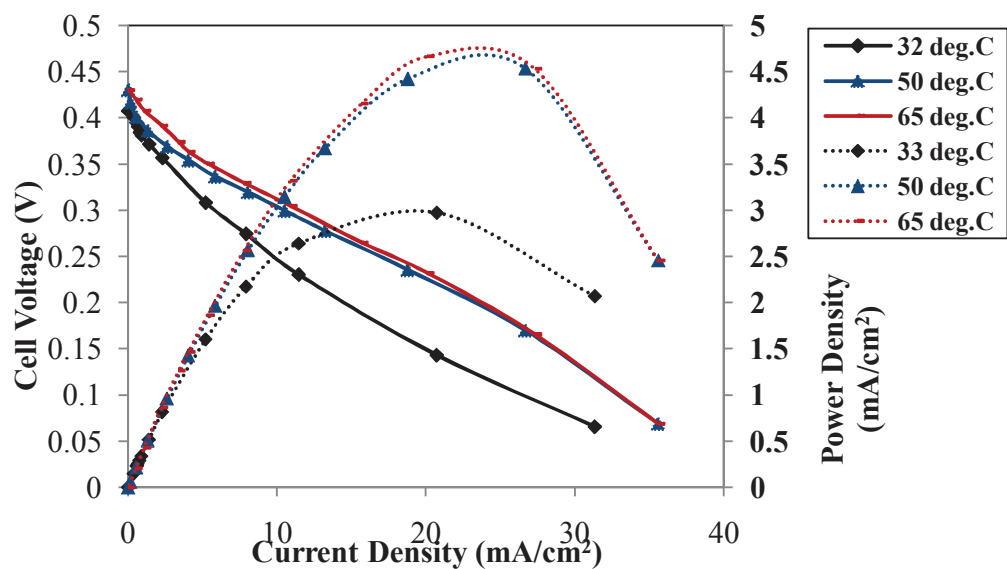


**Figure A2.4b** Current density vs. cell voltage and current density vs. power density curves for 0.5 M ethanol mixed with 1 M KOH as electrolyte at different cathode electrocatalyst loading of Pt/C<sub>HSA</sub> and anode at fixed loading of 1 mg/cm<sup>2</sup> Pt-Ru/C<sub>HSA</sub>; Temperature 34 °C; Solid lines-polarization curves; Dotted lines-power density curves.

### A2.5 Effect of Temperature



**Figure A2.5a** Current density vs. cell voltage and current density vs. power density curves using different temperatures of MFC for methanol concentration of 0.5 M mixed with 1 M KOH as electrolyte on Pt-Ru/C<sub>HSA</sub> anode and Pt/C<sub>HSA</sub> cathode at loading of 1 mg/cm<sup>2</sup>; Solid lines-polarization curves; Dotted lines-power density curves.



**Figure A2.5b** Current density vs. cell voltage and current density vs. power density curves using different temperatures of MFC for ethanol concentration of 0.5 M mixed with 1 M KOH as electrolyte on Pt-Ru/C<sub>HSA</sub> anode and Pt/C<sub>HSA</sub> cathode at loading of 1 mg/cm<sup>2</sup>; Solid lines-polarization curves; Dotted lines-power density curves.