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Long-run Operation of a Methanol Fuel Cell
메탄올 연료전지의 장시간 운전

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Many efforts have been made to study DMFC long-term test for preparation of an improving electrocatalyst, low mass transfer controlled electrode and low methanol crossover membrane. In this paper, we focus on long-term behavior of membrane and electrode (MEA) with different carbon substrates in terms of anode, cathode and overall potentials. TEM is conducted to understand morphological change of catalyst before and after methanol test.

The fabricated MEA was installed into the single cell with reference electrode (RHE), and the three electrodes measurement (galvanostatic mode using current density of 100mA/cm^2) was conducted with 1M methanol and air at 40°C. In this measurement, active electrode area is 10cm 2, the flow rate of methanol and air is used 3 times of stoichiometric flow. After the methanol test, the TEM measurement was conducted to investigate morphological change of catalyst and the MEA interface.

Two MEAs with different carbon substrates (A and B) were prepared to test the transport of reactants and products in the membrane, electrode and flow channel for DMFC operation. Substrate B has higher porosity than substrate A, while the substrate B is thicker than the substrate A. For, substrate A, when the overall potential was changed 0.34 to 0.24V, the cathode potential was dropped from 0.77 to 0.70V compared to the anode potential was decreased 0.43 to 0.46V. Decrease of overall cell potential was attributed to the reduction of cathode potential rather than that of anode potential for both MEAs. To better understand the degradation of cathode, TEM was measured catalysts before and after methanol test. Pt cathode catalyst was originally sphere with average diameter of 3-5nm. However, the particle was coagulated to a little long shape with average diameter of 3-9nm. It is indicated that the Pt particles were coagulated with long-term test, and reaction heat may stimulate the coagulation of the particles.