An effective layout of polyaniline nanofibers incorporated in membrane-electrode assembly as methanol transport regulator for direct methanol fuel cells

C.W. Lin*, Y.F. Huang, C.S. Chang
Department of Chemical and Materials Engineering, National Yunlin University of Science and Technology, Yunlin 640, Taiwan

This study reports a novel strategy by using polyaniline nanofibers (PANFs) to modify membrane-electrode assembly (MEA) for improving direct methanol fuel cell (DMFC) performance. First of all, a series of emeraldine salt PANFs was synthesized and characterized. Then, we investigate the effect of PANFs layout in MEA on DMFC performance. The three different placements to incorporate the as-synthesized PANFs in anodes include (1) between catalyst layer (CL) and proton exchange membrane (PEM), (2) mixed in catalyst slurry, and (3) between CL and gas diffusion layer (GDL). Polarization curves (Figure 1) indicate that the third method is superior to the others and is adopted as the incorporation layout thereafter. Both methanol transport resistance and methanol crossover of the PANFs-modified MEA are studied further. The DMFC incorporated with H₂SO₄-doped PANFs obtained after the re-doping process with 2M H₂SO₄ performs a power density as high as 53 mW cm⁻², about 20% higher than that of the pristine one without PANFs incorporation (Figure 2). However, an excessive doping level may result in a higher methanol transport resistance due to PANFs aggregation and thus deteriorate DMFC performance. These findings provide a simple and effective way by using PANFs properly to act as methanol transport regulator in anode and consequently improve DMFC performance.

**Keywords** polyaniline, nanofiber; methanol transport regulator; gas diffusion electrode; direct methanol fuel cell

![Figure 1](image1.png)  ![Figure 2](image2.png)