ACTIVITY AND STABILITY OF PALLADIUM-GOLD MULTIWALL CARBON NANOTUBES SUPPORTED CATALYST IN DIRECT FORMIC ACID FUEL CELLS

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Fuel cells are classified as one of the ten technologies which will change our life in the near future. Direct formic acid fuel cells (DFAFC) can be a viable power source, particularly for portable applications. The most significant issues in this fuel cells are activity and stability of catalysts used at the electrodes. It is well established that palladium performs particularly well as an anode catalyst.[1] It has been shown that addition of the second metal increases the activity of Pd-based anode catalysts for formic acid electrooxidation.[2]

In our studies, we investigated Pd and Pd-Au solid solution nano-particles supported on multiwall carbon nanotubes (MWCNTs) catalysts. The catalysts were synthesized via polyol method followed by heat treatment in H_2-Ar at 200°C or Ar at 250°C. The average diameter of the deposited Pd-Au nanoparticles was around 4-5 nm. The catalysts were characterized using X-ray diffraction, FE-TEM and EDX.

The catalysts were used for the prepartion of the anode of DFAFC. It was found that the method of heat treatment of the catalysts significantly influenced DFAFC performance. Pd catalysts annealed in H_2-Ar performed better than that annealed in Ar. Addition of gold to MWCNTs-supported palladium improved catalyst initial activity. It was found that the maximum fuel cell power density for Pd-Au/MWCNTs catalyst is 26% higher than that for the similarly prepared Pd/MWCNTs catalyst. The main reason of deactivation of investigated catalysts is poisoning of palladium surface by product of decomposition of impurities present in formic acid (e.g. acetic acid and methyl formate). The deactivation of this catalysts increases rapidly with applied current.

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[2] R. Larsen, S. Ha, J. Zakzeski, R. I. Masel, *J. Power Sources* **2006**, *157*, 78.