

**NEW RESULTS FOR MAXIMIZATION OF CO
TOLERANCE OF HYDROGEN AND
REFORMATE PEM FUEL CELLS**

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From the point of view of development of polymer electrolyte fuel cell technology, one of the most troublesome impurities in reformat fuels is residual carbon monoxide, CO [1]. In previous work at Los Alamos National Laboratory, a minimal air-bleed was added to the fuel stream to catalyze oxidation of CO. Originally, this reaction was catalyzed by the platinum anode catalyst itself [2]. As reported in the previous paper [3], it was later found more effective for a CO oxidation catalyst to make contact with the gas prior to the anode gas reaching the anode active layer. Savings in platinum or other precious metals were obtained by using catalysts such as transition metal oxides.

In the production of reformat fuel, complex processing to remove CO would significantly increase the capital costs. Hence, targets set by DOE call for tolerance to 500 ppm CO. Normally this is enough CO to rapidly stop the operation of a polymer electrolyte fuel cell. This is illustrated in Figures 1 and 2, which show cell polarization curves after exposure to CO for 30 minutes, operating at 0.6 volt.

In recent work, we have investigated a number of new catalysts for the application described in the previous paper. Tests have been carried out on hydrogen and synthetic reformat with 100-500 ppm CO, using air-bleeds of 6% or less. Nafion® – based MEAs having anodes with both high and low intrinsic tolerance to CO were tested. For instance, Figures 1 and 2, show the differences between 100, 300, and 500 ppm CO in hydrogen. For the intermediate CO level, 6% air-bleed gave a high level of tolerance when Fe₃O₄ was present in the anode backing layer. Further progress towards meeting the abovementioned DOE target will be described in detail, and prospects for application in fuel cell technology will be briefly discussed.

References

1. S. Gottesfeld and T.A. Zawodzinski, in *Advances in Electrochemical Science and Engineering*, Vol. 5, Wiley-VCH, New York (1997) 195-301 (see p 219).
2. S. Gottesfeld and J. Pafford, *J. Electrochem. Soc.*, 1988, 2651-2652.
3. F.A. Uribe and T.A. Zawodzinski, see abstract in this volume.

Acknowledgment

We gratefully acknowledge funding from the US DOE Office of Advanced Automotive Technology.

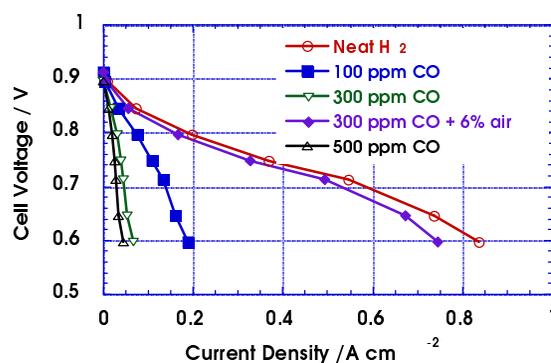


Figure 1. Effects of 100 to 500 ppm CO in hydrogen, on anode FC performance at 80 °C. Cell size 50 cm². Anode loading 0.20 mg Pt cm⁻². Cathode 0.22 mg Pt cm⁻². Anode backing 0.59 mg Fe₃O₄ cm⁻².

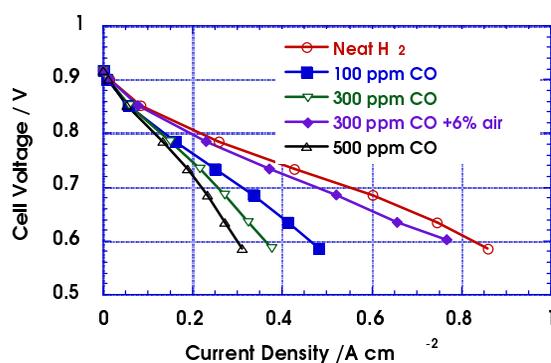


Figure 2. Effects of 100 to 500 ppm CO in hydrogen, on anode FC performance at 80 °C. Cell size 50 cm². Anode loading 0.18 mg Pt cm⁻² as Pt/Ru. Cathode 0.46 mg Pt cm⁻² as Pt₃Cr. Anode backing 0.58 mg Fe₃O₄ cm⁻².