A PEM Fuel Cell Stack Operated at Higher Temperatures

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Proton exchange membrane (PEM) fuel cells have attracted enormous interest as the most promising candidate for stationary, mobile, and portable power applications owing to their high energy efficiency when compared to that of internal combustion engines and ultra low or zero emissions of environmental pollutants. Especially, operation of PEM fuel cells at elevated temperatures (≥100^{o}C) alleviates carbon monoxide poisoning of the anode catalysts from impure hydrogen feed, makes heat rejection of a fuel cell easier, increases system efficiency, and accelerates the electrochemical reaction kinetics. Numerous studies have been conducted to improve the electrolyte membrane and increase electrode performance for operation at higher temperatures with lower humidity. Several works reported high performance MEAs in the range of 100^{o}C~190^{o}C using oxygen at ambient pressure or pressurized conditions[1-2]. In our lab, a high cell performance of 0.6V at 400mA/cm^2 at 120^{o}C/35% relative humidity at ambient pressure using air has been reported[3]. However, large-scale application of PEM fuel cells is still limited by the fuel cell stack, cost and reliability related to stack design and operation. No literature shows performance scale-up from singe cells to stacks at higher temperatures, lower humidity and ambient pressure.

In present work, a scale-up process to 300cm^2 single cells and stacks was studied and developed, including the membrane and catalyst-coated membrane manufacturing approach, fabrication of the full-scale single cell and stack, testing conditions and basic system design. A scale-up MEA and stack is shown in Fig.1. The effects of cell or stack design and testing have been verified. More experimental details and performance on the full-scale single cells and stacks will also be presented.

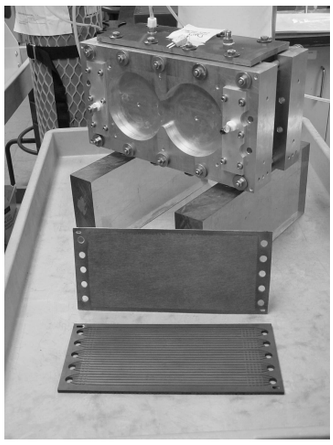

Fig.1 A scale-up MEA and stack at UConn

Reference:

1. Costamagna, P., Yang, C., Bocarsly, A. B., Srinivasan, S., Electrochimica Acta, 47 (2002) 1023
2. Hasiotis, C., Qingfeng, L., Deimede, V., Kalitsis, J. K., Kontoyannis, C. G., Bjerrum, N. J., J. Electreochemical Society, 148, 5, A513 (2001)
3. Song, Y., Bonville, L. J., Kunz, H. R., Fenton, J. M., Carley, R., Farris, P., Trahiotis, M., Wei, Y., Li, J., Abstract No. 1181, 203rd Meeting of the Electrochemical Society, Paris, France, April, 2003