High Efficiency, Low Cost Electrode for Proton Exchange Membrane Electrolyzer Cells (PEMECs)

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The Problem:

Though PEMEC technology has emerged as an ecologically friendly method for production of hydrogen for energy use via water hydrolysis, such solid polymer electrolyte electrolyzer systems still suffer from the problems of (1) complicated and costly electrode production, (2) performance degradation of ionomer catalyst coatings, and (3) reactant/product transport issues through the micropores of porous transport layers (PTL) and liquid-gas diffusion layers (LGDLs).

The Solution:

Researchers at the University of Tennessee have developed a novel electrode for PEMECs which consists of (1) a novel bipolar plate flow field, (2) a novel liquid/gas diffusion layer (LGDL) and (3) a thin ionomer-free catalyst layer. The thin porous LGDL (25-100um thickness with hydraulic diameter of 25 um to 400um and a porosity of 20% to 70%) and optimized flow field results in significantly less obstruction to mass transport of reactants and products. The ionomer-free catalyst can be applied through facile and room temperature electroplating or chemical synthesis reducing the expensive platinum group catalyst loading by 90% while having limited degradation

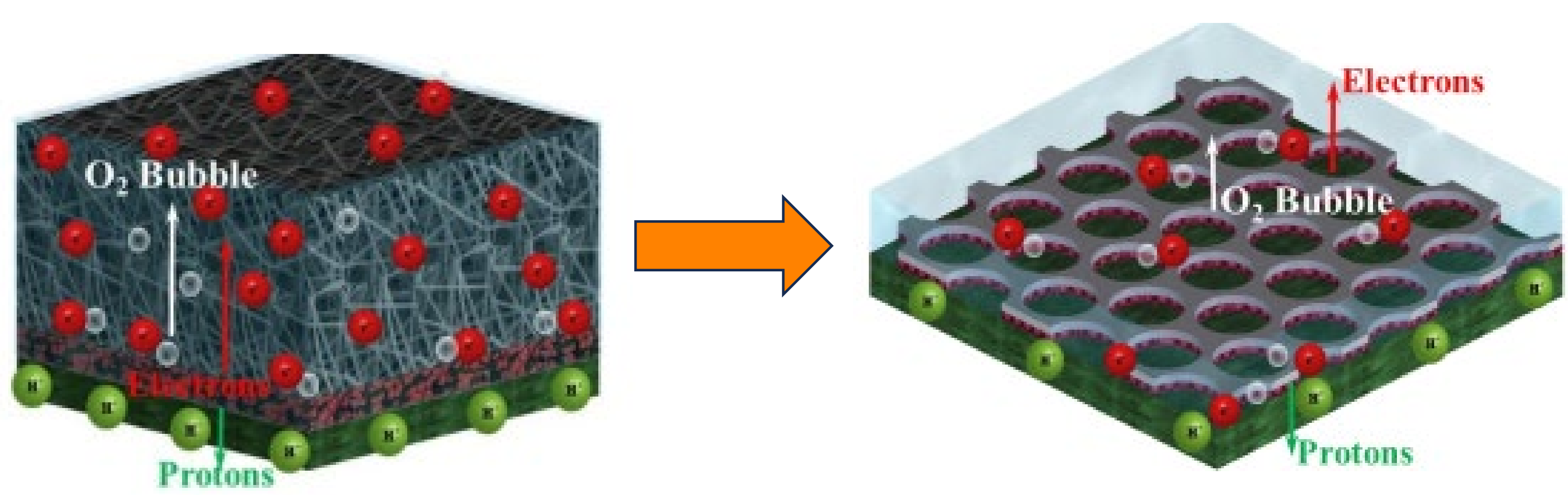

Figure 1: Illustration of thick porous transport layer/CCM versus novel catalyst-coated LGDL.

Benefits:

- Significant cost-savings through lower catalyst utilization and PTL material saving.
- Easy electrode fabrication through room temperature application procedures.
- Reduction in electrode thickness with limited degradation.
- Increased mass transport and reduction in parasitic losses.

INVENTORS

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Dr. Zhang received his Ph.D. from Japan's Nagoya University in 1999. His research interests include electrochemical energy storage and conversion systems, advanced spectroscopy, MEMS/NEMS and electrolyzer/battery technologies.

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