VANDERBILT UNIVERSITY

CTTC Center for Technology Transfer & Commercialization

Nanofiber Composite Membranes for Alkaline Fuel Cells

Summary

A new nanofiber composite membrane morphology and fabrication scheme has been developed at Vanderbilt University to be used for alkaline anion-exchange membrane fuel cells (AAEMFCs). This membrane has high hydroxyl ion conductivity, good mechanical properties, long term chemical stability and low water swelling. Additionally it is well suited for harsh conditions including high temperature and low humidity.

Addressed Need

- Most commercial anion exchange membranes (AEMs) cannot withstand harsh environments of AAEMFCs
- Hydroxide anions have low inherent mobility affecting ionic conduction in the membrane
- Traditional high ion-exchange capacity polymers result in brittle dry membranes and wet membranes with poor mechanical strength
- Commonly used PEM membranes require the use of expensive platinum catalysts at the electrodes

Technology Description

A dual fiber electrospinning approach was used to create a dense and defect free membrane to be used for alkaline fuel cells. This novel morphology allows for high hydroxide conductivity (40mS/cm) and exceptionally low equilibrium water swelling (70% at 23° C vs 170%), enhancing the mechanical properties of existing AEM technologies. The membrane undergoes stress break at 25 MPa with a 7% elongation, where as competitors are so brittle they crumble with handling. The nanofiber membrane exhibits desired characteristics rivaling that of existing PEM technologies such as Nafion; however, in exceedingly harsh conditions this novel membrane maintains its integrity while competitor technologies dramatically degrade in performance.

Commercial Applications

- Long term alkaline and high temperature fuel cells
- Competitor to existing PEM membranes
- High temperature, low humidity fuel cell operations such as auto hydrogen/air fuel cells

Competitive Advantages

- Dense, defect free membrane with high hydroxide ion conductivity (IEC) and low water swelling
- Improved mechanical properties when wet and dry
- Can withstand harsh highly alkaline and high temperature operating environments
- Higher performance due to faster cathode reactions in alkaline electrolytes compared to PEM fuel cells
- Less expensive, non-precious metal catalysts such as nickel or silver

Intellectual Property Status

- A Utility Patent Application was filed in September 2012.
- Click for Inventor Bio
- For More Information: Electrospun Composite Membranes for Alkaline Fuel Cells
- Search for Peter Pintauro in Pubmed

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