



## Electrorheological Manufacturing Method for Proton Transport Membranes and Bipolar Plates

AzTE Case #M4-033

### Inventors

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### Intellectual Property

#### Status:

Patent Pending

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### Background

Proton exchange membranes (PEMs) and bipolar plates are key building blocks for many fuel cells. Typically, a precious metal catalyst such as platinum is also required for fuel cell to operate. Current manufacturing processes waste as much as 85% of this costly metal, failing to deposit the catalyst in contact with the membrane where it is needed. Additionally, most bipolar plates require additional gaskets when incorporated into fuel cell stacks, increasing the complexity and expense of the system.

### Invention Description

ASU researchers have developed an innovative method to create highly efficient PEMs and bipolar plates. Through electrorheological processing of the catalyst and the membrane material, the catalyst can be aligned slightly inside the membrane itself – creating a highly-efficient three-dimensional reaction space. No catalyst is wasted, reducing the amount of material needed. Due to the larger reaction area, the resulting membranes offer improved reaction efficiency and higher power output. The researchers have used similar electrorheological techniques to create bipolar plates. The plates are highly efficient, flexible, and can be incorporated in fuel cell stacks without the typical need for additional gaskets. Fuel cells incorporating these innovations can be produced at a reduced cost, while offering substantially improved performance.

### Potential Applications

- **Portable electronics**
- **Automotive, industrial, and military applications**
- **Primary and secondary fixed power sources**

### Benefits and Advantages

- **Increased Power Density** – Larger active area in the membrane allows for more power to be generated without increasing cell size.
- **Improved Cell Efficiency** – Higher catalyst densities allow for more efficient reactions, capturing more of the available energy.
- **Reduced Catalyst Expense** – By eliminating wasted catalyst, manufacturing costs can be reduced substantially.