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## Technology Fact Sheet - 1677

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### Fe-base Alloy and Nitridation Treatment for PEM Fuel Cell Bipolar Plates

#### Technology Description

The inventors have demonstrated protective nitride formation on two Fe-based alloys. Nitride coatings provide hard surfaces, low friction coefficient, excellent adhesion, favorable sliding characteristics, and relatively high electrical and thermal conductivity to prevent further degradation to the underlying substrate.

This technology can potentially be used in the following applications.

- PEM fuel cell bipolar plates
- Direct methanol fuel cell bipolar plates
- Any solid state electromechanical device needing metal components with low contact resistance and high corrosion resistance

#### Statement of Problem Solved

Bipolar separator plates are one of the more expensive components in polymer electrolyte membrane (PEM) fuel cells designed to power automobiles. Using less expensive materials and simplifying the manufacturing process would reduce the cost of bipolar separator plates. However, any change in design must be introduced without compromising fuel cell stack performance.

Bipolar plates are typically made of graphite or composites because of the low contact resistance and high corrosion resistance these materials offer relative to metals. However, graphite and composites are lacking in other areas relative to metals. This disclosure describes a way to achieve low contact resistance and high corrosion resistance in a Fe-base alloy.

#### Product Differentiation and Benefits

The current state of the art in bipolar plate material is thick graphite or composite plates. Both of these materials are far from ideal because graphite is brittle and not suited for mass manufacturing, and composites are not good electrical conductors. Graphite and composites are used because they offer low contact resistance and high corrosion resistance. Metals are easier to mass manufacture and are generally more durable.

This disclosure uses nitridation as a method to overcome the disadvantages associated with metals so that metal bipolar plates in fuel cells are a practical alternative to graphite and composite plates. Also disclosed are the compositions of the Fe-based alloys that demonstrated protective nitride formation.

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