



Graphite-epoxy composite for bipolar plates in PEM fuel cells

Overview

Bipolar plates (BPP) constitute about 25% of the cost of state-of-the-art PEM fuel cells. More cost-effective materials and production technologies are urgently needed to bring down the plate cost. Furthermore, it is a major trend in PEM fuel cell development to raise the fuel cell temperature from the present 80 °C to 120 – 150 °C which is improving the CO tolerance of the cell (less sensitive to catalysts poisoning) and heat removal from the stack (especially important for the automotive application). Some companies are bringing H₂PO₄ doped PBI high temperature membranes into the market. However, traditional BPP materials are not stable at the operation temperature of these membranes.

Invention

The invention is a graphite epoxy compound based on a low viscosity epoxy resin, heat activated latent metal amine complex hardener and high loading (70-80 vol-%) of graphite filler. The compound can be compression moulded into a PEM fuel cell composite bipolar plate with a short cycle time of 30 to 300 s depending on the plate size and design.

Due to the very latent nature of the mixed graphite epoxy compound, it can be stored for extended periods in room temperature conditions. Also, this extended pot-life allows various rapid techniques for pre-compacting and degassing of the preform billets before compression moulding into complete bipolar plates.

Solution

Only few companies are offering graphite composite bipolar plates for the fuel cell industry. The production volumes are still low and the prices remain high due to lack of competition. The situation is even worse in the case of high temperature PEM fuel cells operating around 150 °C. The choice of qualified material suppliers is even more limited and machined graphite plates are commonly used.



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Application areas

Graphite composite bipolar plates are competing against stainless steel (SS) plates in PEM fuel cell applications. SS plates are gaining ground in mobile applications where the durability goal is 5000 h only. Graphite composite plates are used in stationary applications where 40000 h durability is needed and more recently in high temperature PEM fuel cells. The customers will be FC (fuel cell) stack manufacturers.

Additional information

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