Case study

Catalyst for fuel cell applications

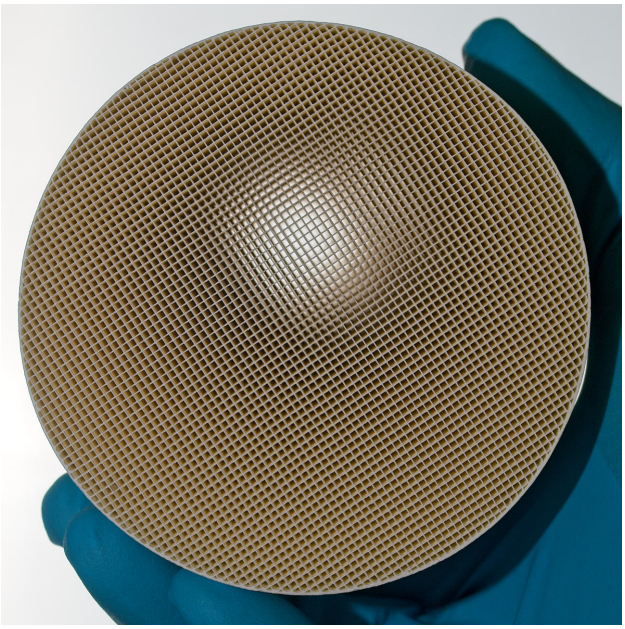
Problem

A leading solid oxide fuel cell (SOFC) manufacturer required a **low-cost catalyst that can operate in their portable, light-weight fuel cell** for sustainable electricity generation.

Why is it a challenge?

Fuel cells convert chemical energy to electrical energy through a pair of redox reactions. Generally, hydrogen is used as the fuel and oxygen is used as the oxidiser. Solid oxide fuel cells can be operated on a variety of other fuels converted (with a dry reforming process) into hydrogen.

Direct internal reforming of the fuels provide low overall system costs, less weight and complexity due to the elimination of the external reformer. **Fuel cells equipped with an integrated internal reforming catalyst layer will lead to simpler designs and higher fuel efficiency.** To be suitable for this process, the catalyst must offer high conversion to hydrogen, in order to maintain the supply to the anode. The catalyst must also be thermally stable in cold-hot cycling and withstand high temperatures (above 700 °C) over prolonged periods of time (>100 hours).

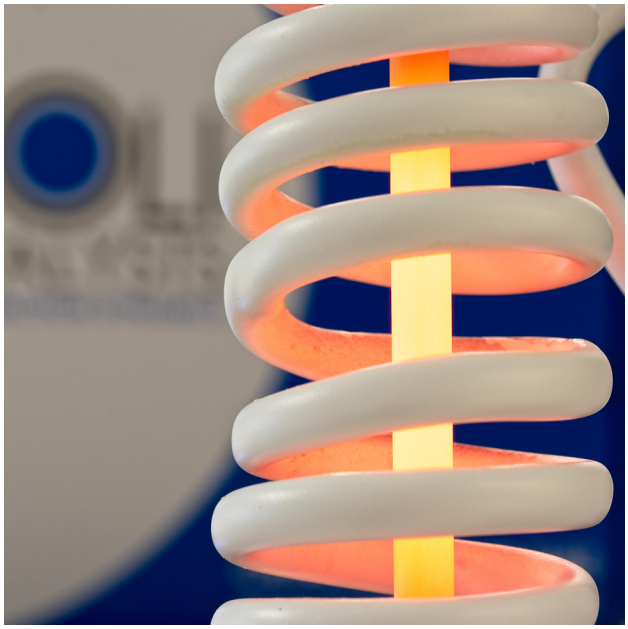


Monolith catalyst support used for fuel cell catalyst manufacture.

What did we do?

Stoli tested a variety of catalyst formulations to determine an optimum catalyst that provided high yields of hydrogen. We used **our proprietary coating methodology to obtain a uniform coating on a high temperature stable monolith** support for low pressure drop allowing the unrestricted flow of catalytically-formed hydrogen to the fuel cell's anode.

We also used radiofrequency heating of the catalyst to perform rapid cold-hot cycles to assess the catalyst stability. **Using radiofrequency heating compared to conventional heating allowed rapid heating and cooling rates** (well above 200 °C/min) for thorough worst-case scenario testing carried out in a fraction of conventional experiment time.



A ¼" reactor tube heated with radiofrequency above 700 °C.

Outcome

Stoli developed stable catalyst samples for the fuel cell manufacturer to improve the overall fuel efficiency and pave the way for small-scale sustainable electricity generation. Application of radiofrequency heating allowed rapid testing of catalyst stability towards cold-hot cycles.

STOLI CATALYSTS