REVERSIBLE FUEL CELLS

Constant choice

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Unitized regenerative fuel cells (URFCs) interconvert fuels, such as hydrogen, and electrical energy. When power is supplied the device splits water electrocatalytically to produce hydrogen, which can be stored, and is run in reverse to produce power. Typically, URFCs are arranged in a so-called constant-gas configuration, where oxygen redox reactions occur at one electrode and hydrogen redox reactions at the other. However, a lesser-explored arrangement is the constant-electrode configuration where each electrode in the URFC always does the same type of reaction — either oxidation or reduction — whether in fuel cell or electrolysis mode, but has to switch between oxygen and hydrogen gas flows depending on the mode. Now, Nemanja Danilovic and colleagues across the USA test URFCs in both configurations and find that the constant-electrode configuration can operate at higher current density and round trip efficiency than the constant-gas setup.

The researchers fabricate proton-exchange membrane URFCs with Ir and Pt-based catalysts at the electrodes. They find that at 80 °C and a current density of 1 A cm⁻², the constant-electrode configuration can achieve a round trip efficiency of 57% compared to 33% for a constant-gas arrangement with similar loadings of the precious metal catalysts. Although the constant-electrode configuration has the added complexity of requiring an inert gas purge when switching between electrolysis and fuel cell modes to avoid mixing of hydrogen and oxygen, the researchers' preliminary cost analysis suggests that the improved round trip efficiency more than offsets this increased capital and operational cost.

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