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Gas diffusion layers that improve catalyst utilization in electrochemical devices

Researchers at Stanford University have developed gas diffusion layers with engineered surface roughness within the gas pathway of electrochemical devices that improves catalyst utilization.

The reaction rates obtainable in electrochemical devices with gas phase reactants or products rely on diffusivity of the gas phase components, which impacts the contact with a solid phase catalyst. Higher diffusivity of gas phase reactants enables a faster reaction rate due to improved catalyst utilization, thus enhancing cell voltage without modifying current density.

In this technology, gas diffusion layers are engineered with surface roughness that increases the surface area between gas phase reactants and the catalyst. The higher surface area increases the effective diffusivity of the gas phase reactants, enhancing the cell voltage and the catalyst utilization. Specifically, compared to unmodified gas diffusion layers, the gas diffusion layers with engineered surface roughness are shown to improve catalyst utilization by over 20% within membrane electrode assemblies. With overall improved performance, the surface engineered gas diffusion layers can be applied to electrochemical devices, such as fuel cells and electrolyzers to increase catalyst utilization.

Stage of Development Proof of Concept

Applications

- Electrochemical devices that involve gas-phase reactions and catalysts such as fuel cells and electrolyzers

Advantages

- The corrugated interface between the gas and catalyst layers improves catalyst utilization by over 20% compared to devices with smooth interfaces

Patents

- Published Application: WO2021202750
- Published Application: 20230163314

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