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Institute of Energy Technologies (IET-4)
Electrochemical process Engineering

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Advanced Metal Bipolar Plate System for Efficient Fuel Cell and Electrolyser Arrays

Technology Description

The invention introduces a novel bipolar plate assembly for forming an electrolysis or fuel cell stacks and to the use of a bipolar plate assembly and an electrolysis or fuel cell stack with a plurality of bipolar plate assemblies. Comprised of a metallic separator, fluid distribution units on both anode and cathode sides, and metallic frame elements ensuring fluid-tight sealing, this assembly enhances fluid distribution, gas separation, and electrical conductivity within the cell.

Problem

Traditional bipolar plates suffer from non-uniform fluid distribution, resulting in temperature and current density inconsistencies, leading to cell damage and accelerated aging. Rigid channel structures limit adaptability to changing operational conditions, complicating fluid distribution and compromising seal integrity. If the components that make up the bipolar plate are placed together during stack assembly, this increases the stack's susceptibility to errors and male function.

Solution

This innovation presents a modular assembly design, allowing for optimal fluid distribution and flexible operation even under varying conditions. Metallic components enable easy integration via fusion methods, such as diffusion welding, ensuring a gas-tight unit. Specifically, the design addresses reliable gas separation, fluid distribution, and mechanical bonding with adjacent membrane-electrode units, enhancing efficiency and adaptability.

Potential Use

The technology's versatility benefits electrolysis and fuel cell stacks, allowing for enhanced fluid management, improved gas isolation, and efficient current distribution. Its adaptability to varying operational conditions and the ability to create a unified structure offer advantages across industries reliant on efficient and reliable energy generation, such as automotive, industrial, and power generation sectors.

Interesting for the following sectors
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IP DE102020109430, WO/2021/197718, EP4128399, US20230163322, JP2023520426

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Keywords
Bipolar Plates, Electrolysis, Fluid Distribution, Metallurgical Construction, Flowfields, Gas Tightness, Corrosion Resistance

More Information
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As of 12/2023

Development Status and Next Steps

Forschungszentrum Jülich has extensive expertise in this field and holds several patents. The technology described above has already been initially verified through prototypes and is continuously being developed further. The Institute of Energy and Climate Research (IEK-14) – Electrochemical Process Engineering - and the Central Institute of Engineering, Electronics and Analytics (ZEA-1) - Engineering and Technology - already cooperate with numerous national and international companies and scientific partners. We are continuously seeking for cooperation partners and/or licensees in this and adjacent areas of research and application.

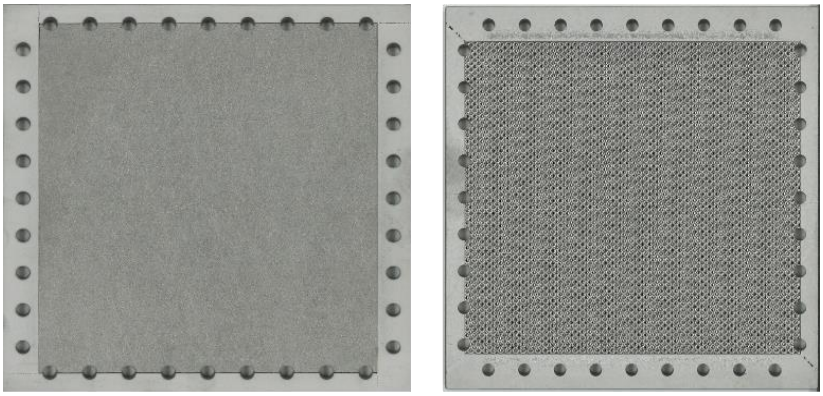

Figure 1: Advanced bipolar plate manufactured by diffusion welding

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