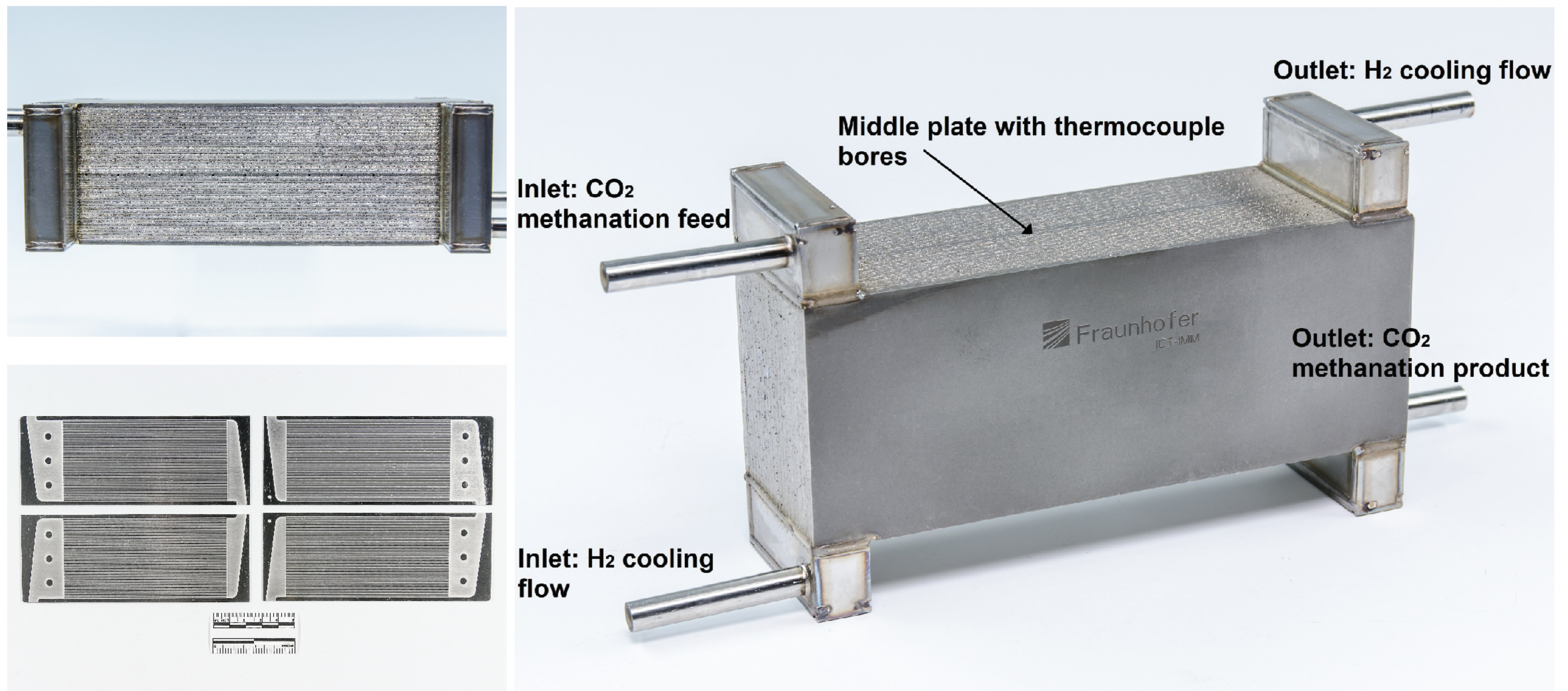


Overview

The fluctuation of solar and wind energy remains arguably the most important challenge in integrating renewable energy sources to the existing electricity grid. The Power-to-Gas concept utilises excess electricity during peak supply, producing hydrogen via the water electrolysis process.

An alternative storage method is the subsequent methanation of the hydrogen with carbon dioxide (CO₂) to produce methane. Methane production benefits from already existing natural gas infrastructure for storage potential, as well as the wide variety of applications in the chemical industry and the power generation sector. The methanation process involves the recycle of industrial CO₂ emissions to produce a valuable chemical (methane). The production of methane enables the effective storage of excess renewable energy, and re-use when the demand-side power is large (e.g. night time or periods of low wind).

Sophisticated reactor technologies supporting flexible load operation (fluctuation of solar and wind) is therefore an essential requirement for Power-to-Gas. Microchannel reactor technology fits this requirement thanks to high heat and mass transfer rates, and the ability to sustain performance under transient conditions.



Power-to-gas concept

Excess renewable electricity during peak supply is used to produce H₂ via the water electrolysis process.

CO₂ is captured and purified from any industrial point source (e.g. petrochemical, coal-fired power plant or cement manufacturing process).

The Sabatier reaction, or so-called CO₂ methanation reaction, involves the catalytic combination of H₂ and CO₂. The Sabatier reaction takes place at moderate temperature (±350°C) and pressure (10-20 bar).

CH₄ is subsequently purified and stored in cryogenic tanks or pressurised natural gas pipelines. When the demand for power increases, and there is a shortage of renewable power generation capacity, CH₄ combustion in gas turbines provides grid balancing.

Advantages

Electricity grid balancing

Conversion and storage of renewable hydrogen using methane

Recycle of industrial CO₂ emissions

Other chemical energy carriers also viable e.g. methanol, ammonia, formic acid etc. (Power-to-X)

South African minerals (PGMs) beneficiation (methanation catalyst)

