

Preheating fuel cells via unused pressure difference with metal hydrides for sub-zero start-up

Mila Dieterich*, Christoph Weckerle, Inga Bürger, Marc Linder

Institute for Engineering Thermodynamics,
German Aerospace Center
Pfaffenwaldring 38-40, 70569 Stuttgart, Germany
*mila.dieterich@dlr.de



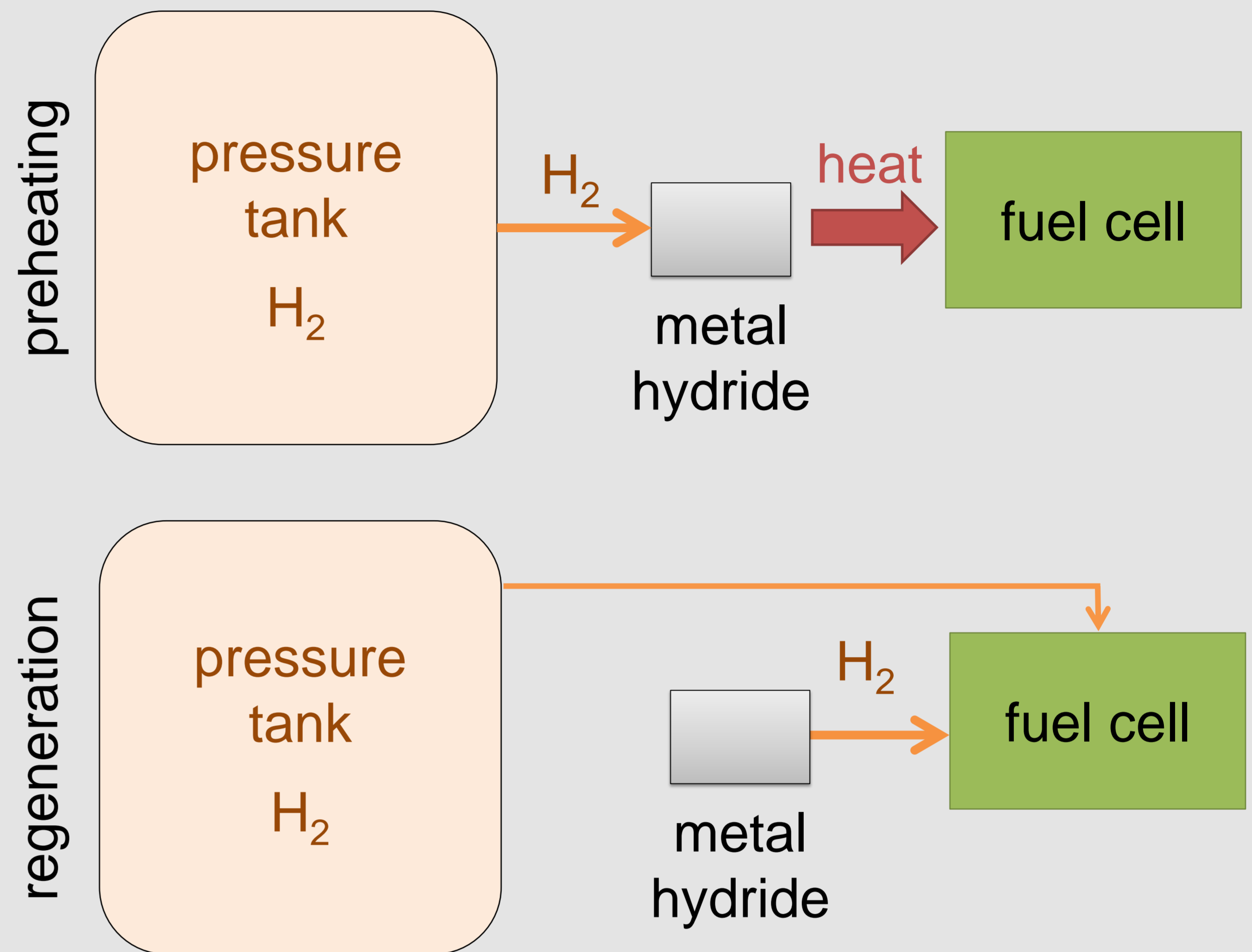
Operation principle



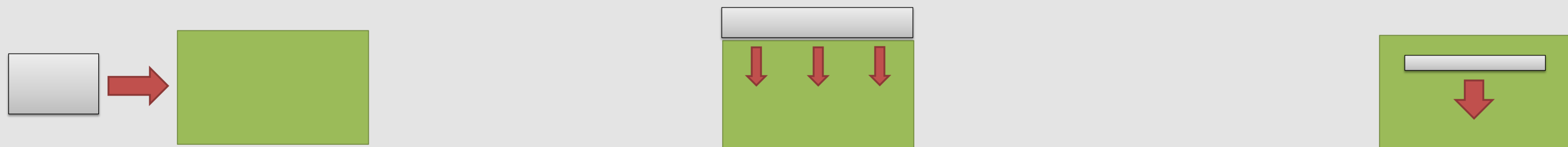
exothermal reaction of metal hydride with hydrogen

Cold start below 0°C

- Freezing water degrades fuel cells mechanically
- 15% energy stored in pressure itself
→ Today: throttled and lost unused
- Metal hydrides can generate heat from pressure difference at high thermal power
- no hydrogen is consumed: desorption to fuel cell at operation due to pressure drop



Several preheater designs for every requirement



Indirect via heat transfer fluid	Direct via heat conduction	
For light duty pedelec	Attached to fuel cell	Integrated into gas channel
<p>Fully modular</p> <ul style="list-style-type: none"> • Patented 3D-aluminum-print with integrated fins • MH-Composites with graphite for high thermal conductivity • 8.6 mm diameter • From -5 to 15°C in 2min 	<p>Large heat transfer area</p> <ul style="list-style-type: none"> • 3D-aluminum-print • 2 mm-tubes for optimal heat transport • designed for temperature raise in fuel cell of 20 K 	<p>Easily refitted to fuel cell</p> <ul style="list-style-type: none"> • Filter tube containing material • No pressure container • No regulation necessary • Freely adjustable to required thermal energy