Heraeus
Precious Metals

Hulteberg

Boosting the Fuel Cell Operation

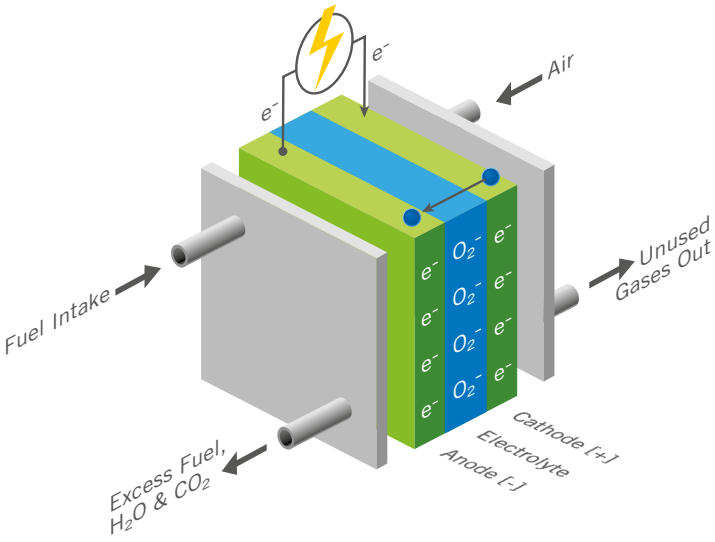
Balance-of-Plant Catalysts & Material Solutions

Hydrogen-based technologies for power generation, such as fuel cells, are expected to play a major role in the transition towards a more sustainable and circular economy. Fuel cells that convert the chemical energy of a fuel and an oxidant directly into electricity, are a key technology in the energy transition – especially as a sustainable decentralized power source.

The journey from a single Solid Oxide Fuel Cell (SOFC) stack to a fully operational system encompasses numerous challenges. Critical to the efficiency and effectiveness of these systems are the balance-of-plant components, which include catalysts, adsorbents, and heat exchangers. Each component must be carefully selected and optimized to enhance the system's overall performance.

The impact of these choices is profound, influencing not only the system's lifetime and operational costs but also its environmental footprint.

Heraeus Precious Metals and Hulteberg via their strategic partnership, are jointly developing and marketing a variety of catalysts that are required for the operation of fuel cells.



The portfolio consists of catalysts for the

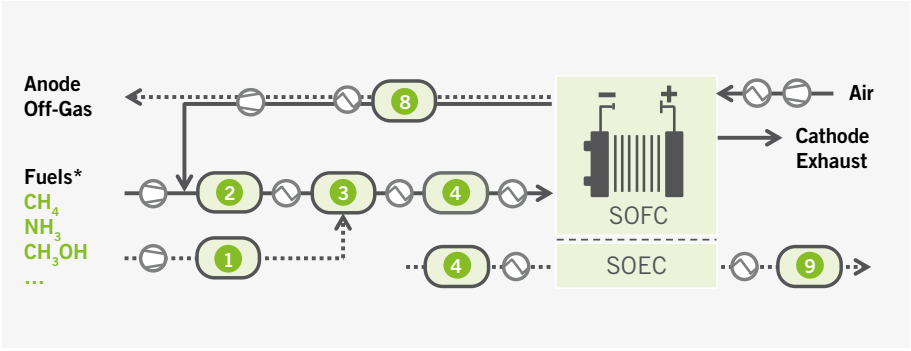
- (pre-)reforming of hydrocarbons and alternate fuels
- generation of syngas (H_2/CO) via catalytic partial oxidation (CPOX)
- purification of syngas via the water-gas shift reaction (WGS)
- preferential oxidation (PROX) and selective methanation reactions to yield pure hydrogen (H_2)
- adsorbents and getter materials
- tail-gas combustion



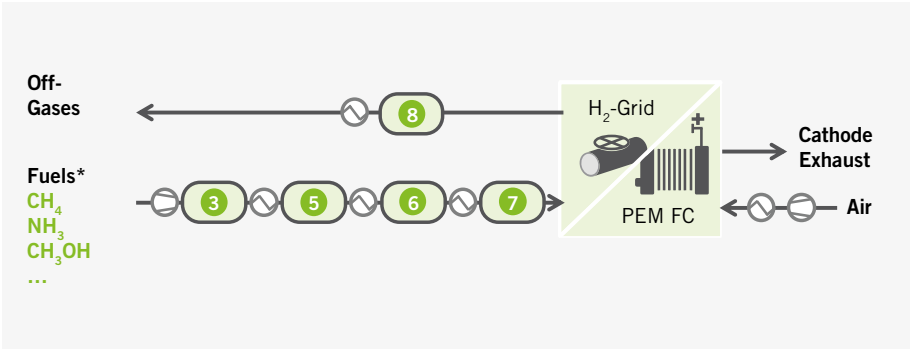


REFORMING CATALYSTS – PORTFOLIO OVERVIEW

Application	Types	Active materials	Common sizes [mm]	Bulk density [kg/m³]
Hydrocarbon Saturation	Coated parts	Pd	Washcoat	N.A.
Biogas Purification	Coated parts	Pd, Pt	Washcoat	N.A.
Catalytic Partial Oxidation	Coated parts	Rh, Pt	Washcoat	N.A.
Pre-Reforming	Coated parts	Ni, Rh, Pt	Washcoat	N.A.
Main Reforming	Coated parts	Ni, Rh	Washcoat	N.A.
Ammonia Cracking	Coated parts	Ni, Ru	Washcoat	N.A.
Methanol Reforming	Coated parts	Doped-PGM	Washcoat	N.A.
All available as coating on tailored structured substrates (honeycomb, knitted wires, ...) or on functionalized hardware!				
Hydrocarbon Saturation	Pellet	Pd	Ø 1.5 x 2.0	1400 – 1600
Biogas Purification	Sphere	Pt, Pd	Ø 2.0 – 4.0	550 – 800
Catalytic Partial Oxidation	Extrudates	Rh, Pt	Ø 1.5	800 – 1200
Pre-Reforming	Sphere	Ni, Rh, Pt	Ø 2.2 – 2.4	500 – 800
Pre-Reforming	Pellet	Ni, Rh, Pt	Ø 3.0 x 3.0	900 – 1400
Main Reforming	Sphere	Ni, Rh	Ø 2.0 – 2.3	500 – 800
Main Reforming	Pellet	Ni, Rh	Ø 3.0 x 3.0	900 – 1400
NH_3 Cracking	Pellet	Ni, Ru	Ø 3.0 x 3.0	1000 – 1200
Methanol Reforming	Pellet	Doped-PGM	Ø 1.5 x 2.0	1400 – 1600
All available in various Ni and/or PGM loadings. Other geometries can be tailored on request.				



Balance-of-Plant (SOFC) – Pre-Converted Hydrogen Fuels



Balance-of-Plant (H_2-Generators) – Fuel Cell Grade Hydrogen

Useful System Components

1. Catalytic Partial Oxidation
2. Fuel Upgrading Catalysts
3. Reforming Catalysts
4. Getter Materials
5. Water-Gas-Shift Catalysts
6. Gas Polishing Catalysts
7. Gas Adsorbents
8. Tail-Gas Combustion Catalysts
9. PtX Catalysts
... further gas treatment options

**Fuels and H_2-storage Media*

PURIFICATION CATALYSTS – PORTFOLIO OVERVIEW

Application	Types	Active materials	Common sizes [mm]	Bulk density [kg/m³]
Hydrogen Deoxygenation	Sphere	Pt, Pd	Ø 2.0 – 4.0	550 – 800
Hydrogen Deoxygenation	Pellet	Pt, Pd	Ø 3.0 x 3.0	900 – 1100
MT Water-Gas-Shift	Pellet	Doped-Pt	Ø 1.5 x 2.0	1400 – 1600
LT Water-Gas-Shift	Pellet	Doped-Pt	Ø 1.5 x 2.0	1400 – 1600
Reverse Water-Gas-Shift	Pellet	Doped-Pt	Ø 1.5 x 2.0	1400 – 1600
Preferential Oxidation	Sphere	Doped-Pt	Ø 2.2 – 2.4	550 – 650
Methanation	Sphere, Pellet	Ru, Ni	Ø 3.0 x 3.0	1100 – 1400
Selective Methanation	Pellet	Doped-PGM	Ø 1.5 x 2.0	1400 – 1600
All available in various PGM loadings. Other geometries and also coatings on structured substrates can be tailored on request.				
Sulphur Adsorbents	Granules	NPM	Granules	Various
Ammonia Adsorbents	Extrudates	NPM	Ø 3.0 x 5.0	550 – 650
LT-Silica Getter	Coated Parts	NPM	Washcoat*	N.A.
HT-Silica Getter	Coated Parts	NPM	Washcoat*	N.A.
Chromium Getter	Coated Parts	NPM	Washcoat*	N.A.
Tail-Gas Combustion Catalysts	Coated Parts	Pt, Pd	Washcoat*	N.A.
**All available as coating on tailored structured substrates (honeycomb, knitted wires, ...) or on functionalized hardware!*				

Contact us and we guide you to the most efficient option for your process including type, (precious metal) loading and recommended operating conditions.

ABOUT HULTEBERG

Hulteberg Chemistry & Engineering is specialized in the research, development, up-scaling and production of heterogeneous catalysts. With a strong focus on catalysts for hydrogen generation, catalysts for the production of electronic components and catalysts for renewable and recycled fuels and chemicals. Based in Malmö. Sweden, the company has accumulated valuable technical and commercial know-how, for example relating to many technologies applied in fuel reformers and in the balance-of-plant of solid oxide fuel cell (SOFC) applications.

ABOUT HERAEUS PRECIOUS METALS

Heraeus Precious Metals is globally leading in the precious metals industry. The company is part of the Heraeus Group and covers the value chain from trading to precious metals products to recycling. It has extensive expertise in all platinum group metals as well as gold and silver.
With about 3,000 employees at 15 sites worldwide, Heraeus Precious Metals offers a broad portfolio of products that are essential for many industries such as the automotive, chemicals, semiconductor, pharmaceutical, hydrogen and jewelry industry.
By 2025 Heraeus Precious Metals will be the first company in the industry that operates carbon neutral.

In recent years Hulteberg and Heraeus have entered a long-term relationship to deliver catalysts for the hydrogen economy. The partnership boosts both companies' standings in the emerging field of SOFCs and the hydrogen economy. Within the scope of the cooperation, Heraeus and Hulteberg jointly approach clients and projects in the hydrogen energy field and commercialize new product innovations that are tailored to clients' needs.

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