Heraeus
Precious Metals

Hulteberg

Boosting Fuel Cell and Electrolyzer Operation

Balance-of-Plant Catalysts & Material Solutions

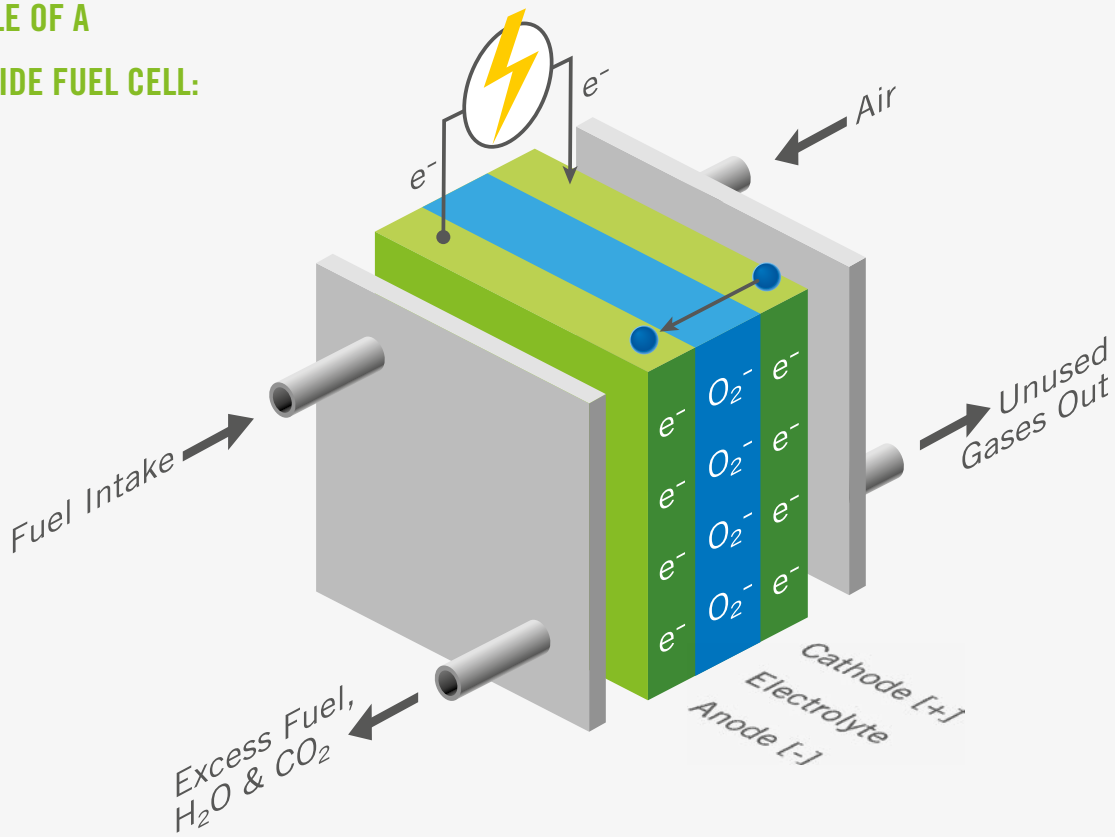
CATALYTIC MATERIALS FOR HYDROGEN-BASED ENERGY TECHNOLOGIES

Hydrogen-based technologies are poised to play a central role in the global shift towards a more sustainable economy:

Electrolyzers use electricity to split water into hydrogen and oxygen, enabling the use of renewable electricity to produce green hydrogen.

Fuel cells, in turn, convert the chemical energy of a fuel and an oxidant directly into electricity. They serve as decentralized power sources and if running on renewable fuels such as green hydrogen, they are a cornerstone of the energy transition.

PRINCIPLE OF A SOLID OXIDE FUEL CELL:



Solid oxide cells (SOCs) in particular offer enhanced efficiency and unique feedstock flexibility, making them ideal for integrated energy and chemical systems. Operating at elevated temperatures, **SOFCs** enable the direct use of different fuels such as methane, ammonia, methanol, or hydrogen, while **SOECs** cannot only produce hydrogen but allow direct routes to syngas or synthetic fuels.

However, transforming a single **solid oxide cell (SOC)** into a fully functional system involves substantial complexity.

At the heart of this challenge lie the **balance-of-plant (BoP) components** – including **catalysts, absorbents, and functionalized hardware** such as heat exchangers.

These components directly impact system efficiency, lifetime, cost, and environmental performance. Selecting the right components—and tailoring them to specific process conditions—is essential for achieving technical and economic viability.

REFORMING CATALYSTS

Application	Common type	Active materials	Common sizes [mm]	Bulk density [kg/m³]
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, Ru, Pt	Ø 2.2 – 2.4	500 – 800
Pre-Reforming	Pellet	Ni, Rh, Ru, Pt	Ø 3.0 x 3.0	900 – 1400
Main Reforming	Sphere	Ni, Rh, Ru	Ø 2.0 – 2.3	500 – 800
Main Reforming	Pellet	Ni, Rh, Ru	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. Type, shape and sizes can be customized on request.				
Hydrocarbon Saturation	Coated Substrate	Pd	Washcoat	N.A.
Biogas Purification	Coated Substrate	Pd, Pt	Washcoat	N.A.
Catalytic Partial Oxidation	Coated Substrate	Rh, Pt	Washcoat	N.A.
Pre-Reforming	Coated Substrate	Ni, Rh, Ru, Pt	Washcoat	N.A.
Main Reforming	Coated Substrate	Ni, Rh, Ru	Washcoat	N.A.
Ammonia Cracking	Coated Substrate	Ni, Ru	Washcoat	N.A.
Methanol Reforming	Coated Substrate	Doped-PGM	Washcoat	N.A.
All available as coating on customized structured substrates (honeycombs, knitted wires, …) or on functionalized hardware!				

PURIFICATION CATALYSTS

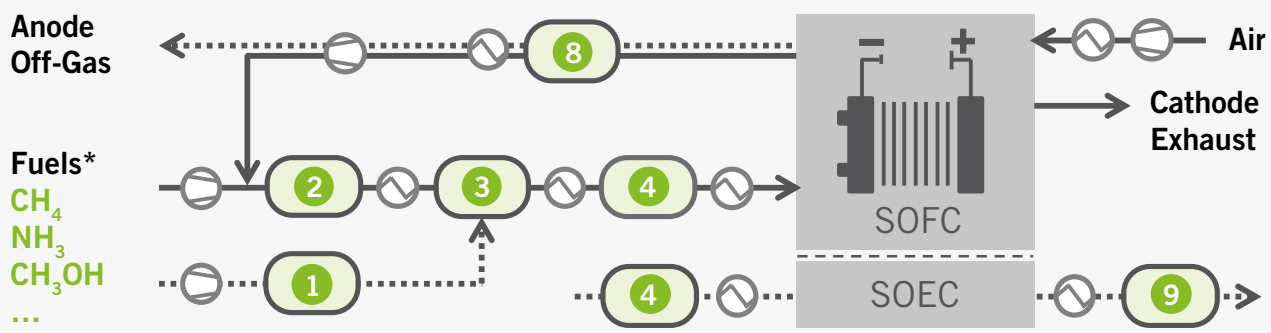
Application	Common type	Active materials	Common sizes [mm]	Bulk density [kg/m³]
Oxygen Dehydrogenation	Sphere	Pt, Pd	Ø 2.0 – 4.0	550 – 800
Hydrogen Deoxygenation	Pellet	Pt, Pd	Ø 3.0 x 3.0	900 – 1100
MT Water-Gas-Shift	Pellet	Doped-Pt	Ø 1.5 x 2.0	1400 – 1600
LT Water-Gas-Shift	Pellet	Doped-Pt	Ø 1.5 x 2.0	1400 – 1600
Preferential Oxidation	Sphere	Doped-Pt	Ø 2.2 – 2.4	550 – 650
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 Absorbents	Granules	NPM	Granules	Various
Ammonia Absorbents	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!*				

SYNGAS UTILIZATION

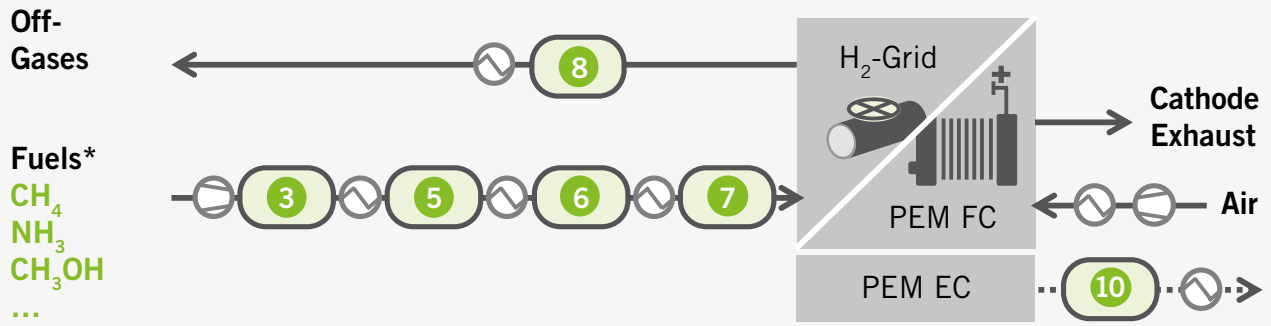
Application	Common type	Active materials	Common sizes [mm]	Bulk density [kg/m³]
Methanation	Sphere, Pellet	Ru, Ni	Ø 3.0 x 3.0	1100 – 1400
Reverse Water-Gas-Shift	Pellet	Doped-Pt	Ø 1.5 x 2.0	1400 – 1600
Fischer-Tropsch	Pellet	Co, Pt	Ø 3.0 x 3.0	1100 – 1400
All available in various PGM or active metal loadings.				

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

BALANCE-OF-PLANT (SOC) – PRE-CONVERTED HYDROGEN FUELS



BALANCE-OF-PLANT (H_2-GENERATORS) – FUEL CELL GRADE HYDROGEN



***Fuels and H_2 -storage Media**

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 Absorbents
8. Tail-Gas Combustion Catalysts
9. PtX Catalysts
10. Deoxygenation / Dehydrogenation Catalyst
- ... further gas treatment options

STRATEGIC PARTNERSHIP FOR HIGH-TEMPERATURE MATERIALS

Heraeus Precious Metals and Hulteberg Chemistry & Engineering are jointly developing and commercializing a portfolio of advanced catalysts and functional materials for fuel processing specifically designed to meet the demanding conditions of high-temperature SOC operation. By combining deep expertise in precious metal chemistry, heterogeneous catalysis and catalytic process engineering, the partners aim to enable next-generation hydrogen technologies through targeted material innovations.

The portfolio consists of catalysts for the

- targeted pre-reforming of hydrocarbons and alternate fuels
- generation of syngas (H_2/CO) via reforming or 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)
- reverse water-gas shift (rWGS), methanation or Fischer-Tropsch (FT) processes for Carbon Capture and PtX
- absorbents and getter materials
- tail-gas combustion

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 cell (SOC) applications.

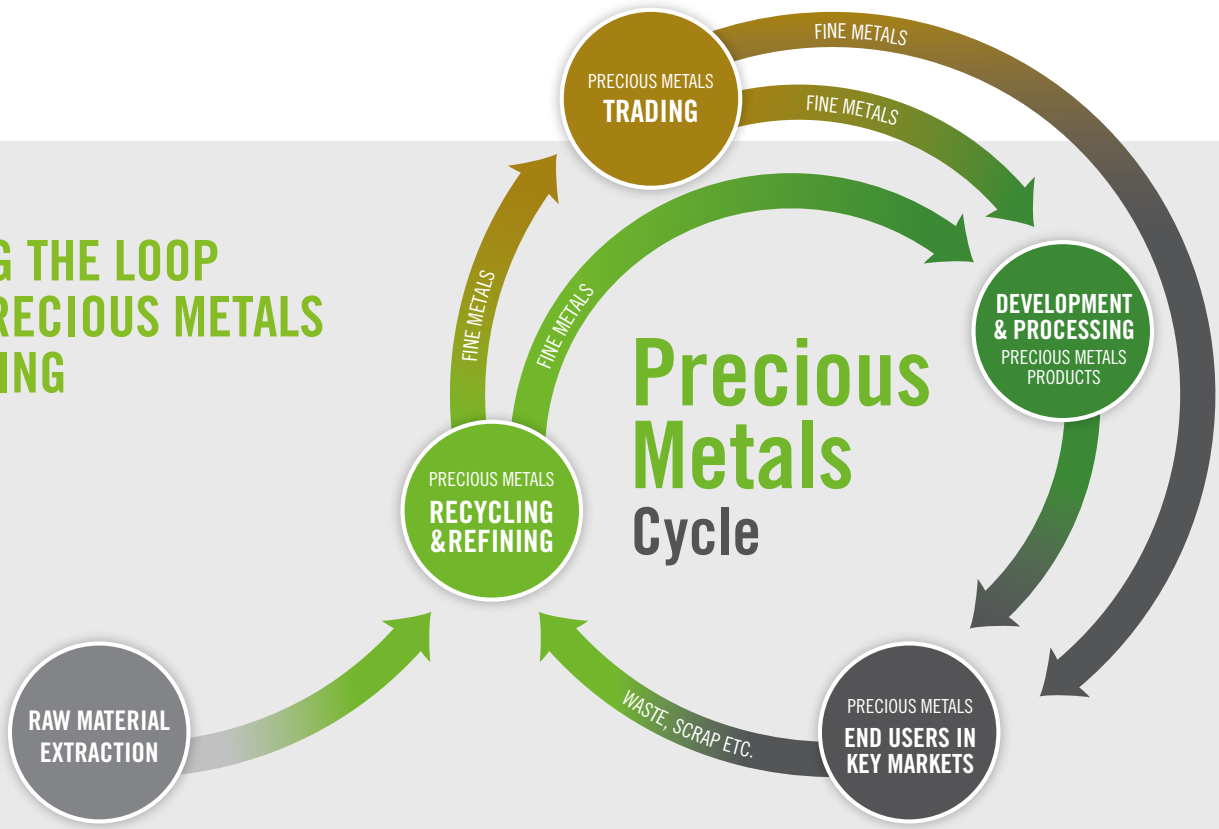
ABOUT HERAEUS PRECIOUS METALS

Heraeus Precious Metals is one of the world's leading players in the precious metals industry.
As part of the Heraeus Group, the company covers the value chain from trading to precious metals products to refining and recycling. It has extensive expertise in all platinum group metals as well as gold and silver.
With about 2,500 employees at 11 sites worldwide, Heraeus Precious Metals offers a broad portfolio of products that are essential for many industries such as the automotive, chemicals, semiconductor, aerospace, pharmaceutical and hydrogen industry.

OUR PARTNERSHIP FOR YOUR BENEFIT

In recent years Hulteberg and Heraeus have entered a long-term relationship to deliver catalysts for the hydrogen economy. The partnership boosts both companies' standing for balance-of-plant components in the emerging field of high-temperature fuel cells and electrolyzers, hydrogen generation and utilization. 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, offering you a comprehensive portfolio for your system operation and component functionalization.

CLOSING THE LOOP WITH PRECIOUS METALS RECYCLING



As a specialist in the handling of spent precious metal catalysts, Heraeus uses state-of-the-art technologies to pretreat, sample, and refine your valuable materials and ensure high return rates. The reclaimed precious metal can be used again for the manufacture of new catalysts, reducing the demand for primary precious metals.

YOU WANT TO LEARN MORE ABOUT PRECIOUS METALS AND HYDROGEN?

Comprehensive details on precious metals in hydrogen applications in the white paper

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