CRIMAREC

Critical Material Recovery

CriMaRec Aps (CVR 30787458)
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About

Origin

Technology spin-out from university R&D based on intellectual properties since 2018

Core competence

Environmentally friendly recovery of platinum group metal (PGM) & non-PGM catalysts from spent products

Open for

Business cooperation, partnership, investment, joint project consortium

Team composition

Shuang Ma Andersen
CTO / Co-founder / PhD

Experienced researcher, principal investigator in energy materials, electrocatalyst, interface structure and expertise in PGM catalyst recycling

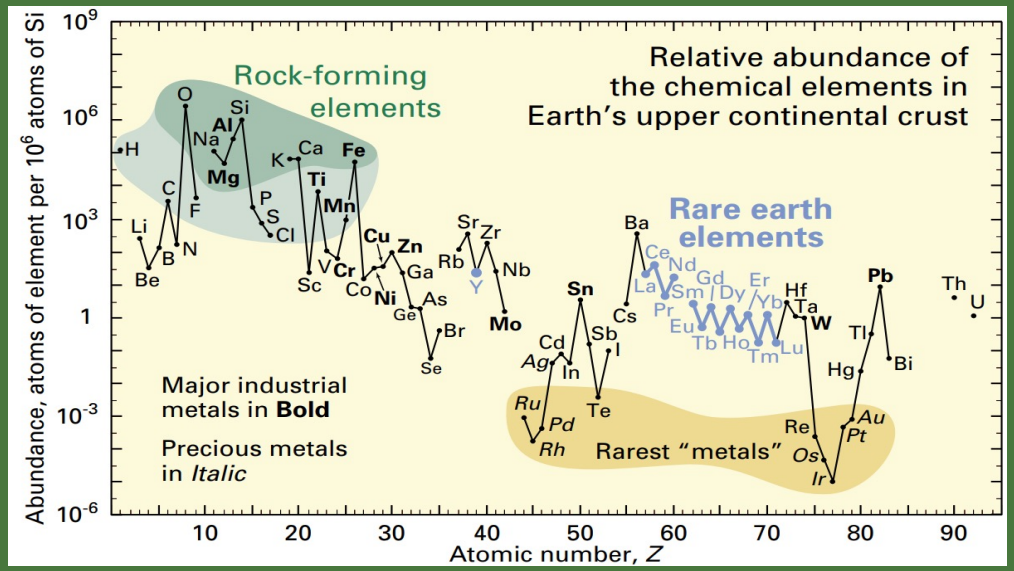
Lars Christian Larsen
CEO / Co-founder / MBA

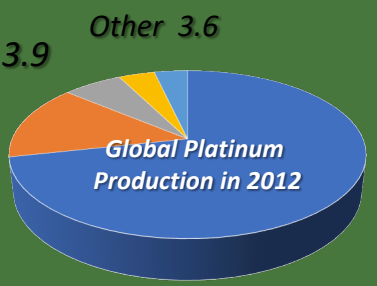
25 years' experience in industrial catalyst market for diesel vehicles using PGMs, high-level management, entrepreneurship & market analysis.

Jens Kristian Damsgaard
Chairman of the board / MBA

Co-founder of several tech university spin-outs, specialized in technology transfer, venture capital, and corporate venturing.

Platinum Group Metal (PGM) basics





Gordon B. Haxel, Sara Boore, and Susan Mayfield from USGS 2021

Background

Classic recycling is in-flexible, expensive, and energy consuming

Large amounts of PGM has been used for catalysts and filters for combustion engines in the past – large recycling potential

25% of all goods manufactured either contain a PGM or had a PGM play a key role in its production

PGM is one of the 27 critical raw materials identified by EU

PGM is a scarce resource but is a requirement for future catalysis, fuel cells and hydrolysers

End-of-Life fuel cells (MEA) and hydrolysers need to be recycled

End-of-Life catalysts and filters to be recycled and the PGM recovered for new products technologies

Portfolio coverage

Renewable energy

Electrochemical energy conversion systems: fuel cells and electrolyzers

Emission control

Internal combustion engine after treatment units: autocatalyst with ceramic support

Chemical conversion

Chemical synthesis: heterogeneous catalysis using ceramic carrier

Value proposition

Shorten value chain, transportation and lead time
Simplified process can be applied individually according to customer demand with significantly reduced lead time

Low initial investment, flexible batch process
Reactors of different size and non continuous operation can be engineered according to capacity needed

Eco-friendly, reduced CO_2 emission
Mild reaction conditions, environmentally friendly reagents, low energy consumption, low requirement for infrastructure comparing to traditional operation

Unique multi circular economy
Both PGM elements and matrix of high value (e. g. proton conducting membrane) can be recovered to generate added value

Combination of recycling with production
Direct manufacture of new products, possibility of a closed loop or cross loop economy and new business model

Accelerate green transition
Significantly reduce capital cost of product manufacture, secure sustainability of the renewable energy & green transition of emission control

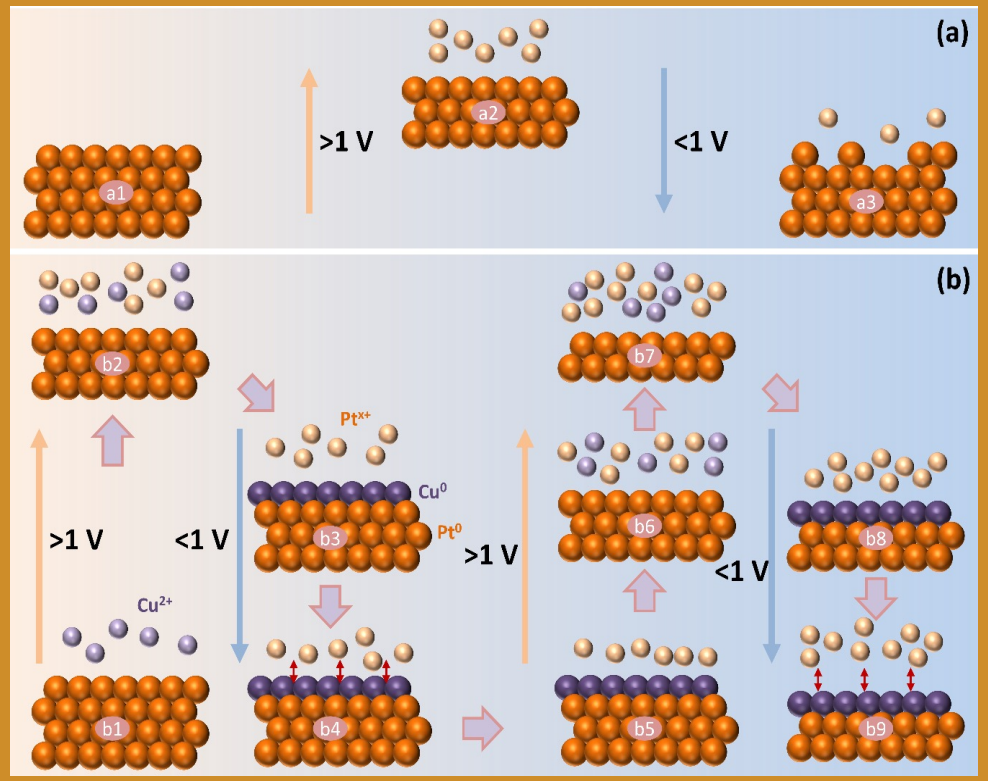
Economically viable technology

Up-scalable through classic engineering

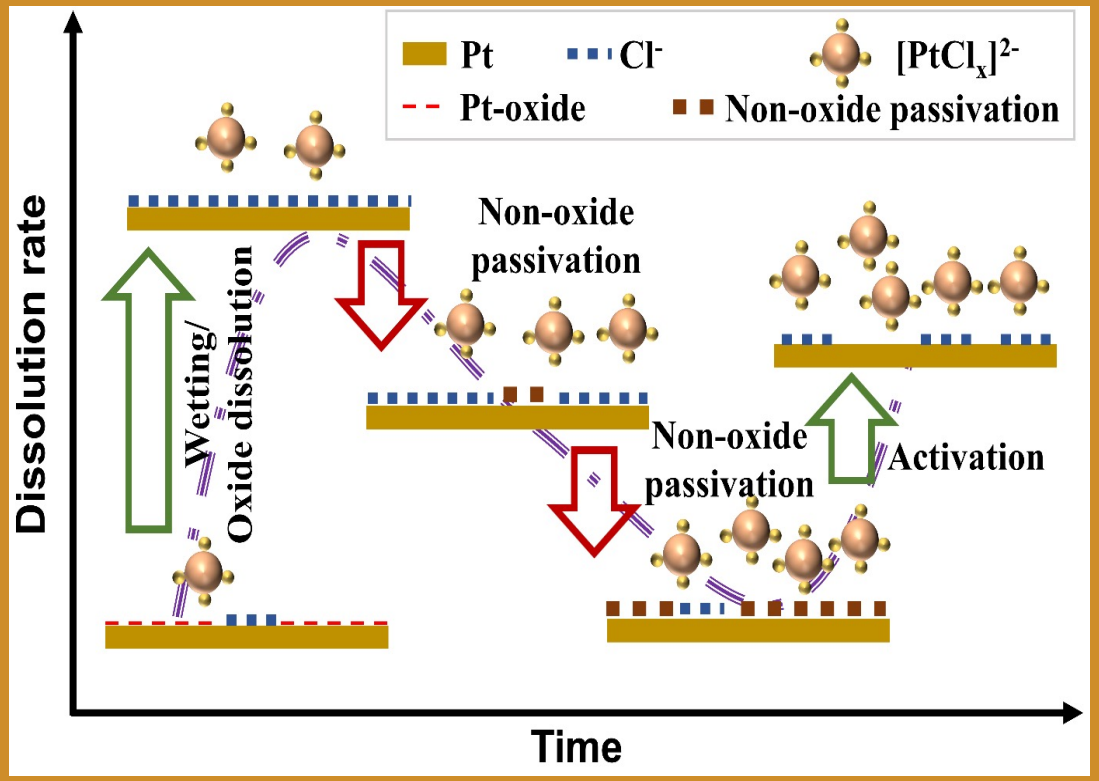
Registered IPs and exclusively licenses

Clean PGM recovery process

Innovation technologies



- Electrochimica Acta 321, 134662, 2019
- Physical Chemistry Chemical Physics, 22 (2020) 13030-13040.

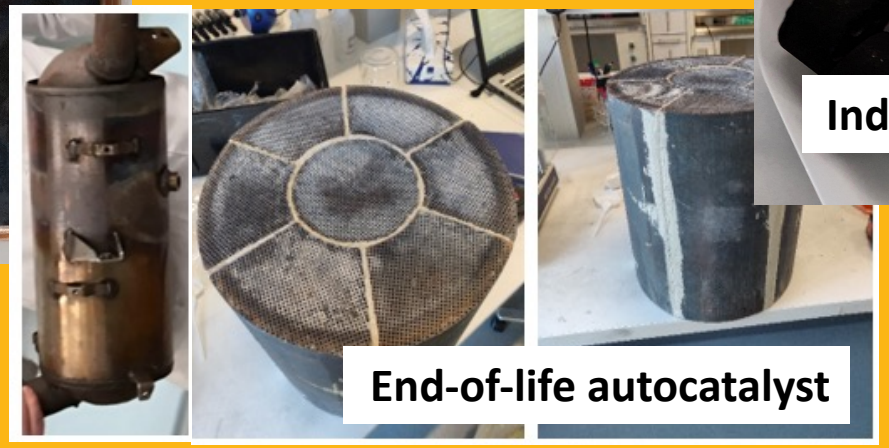


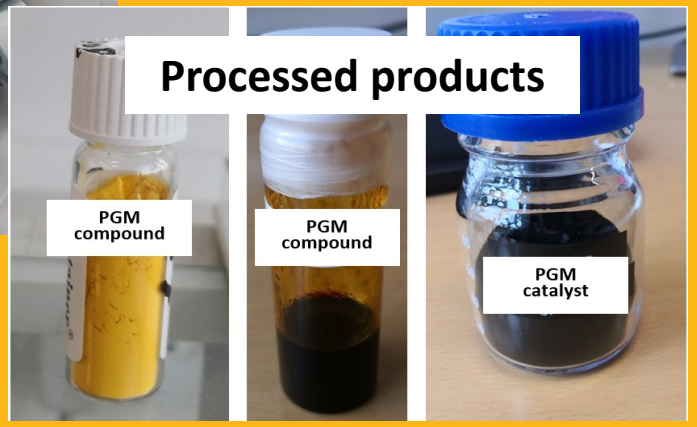
- ChemSusChem 11 (21), 3742-3750, 2018
- The Electrochemical Society 166 (13), F963-F970, 2019

Process and materials

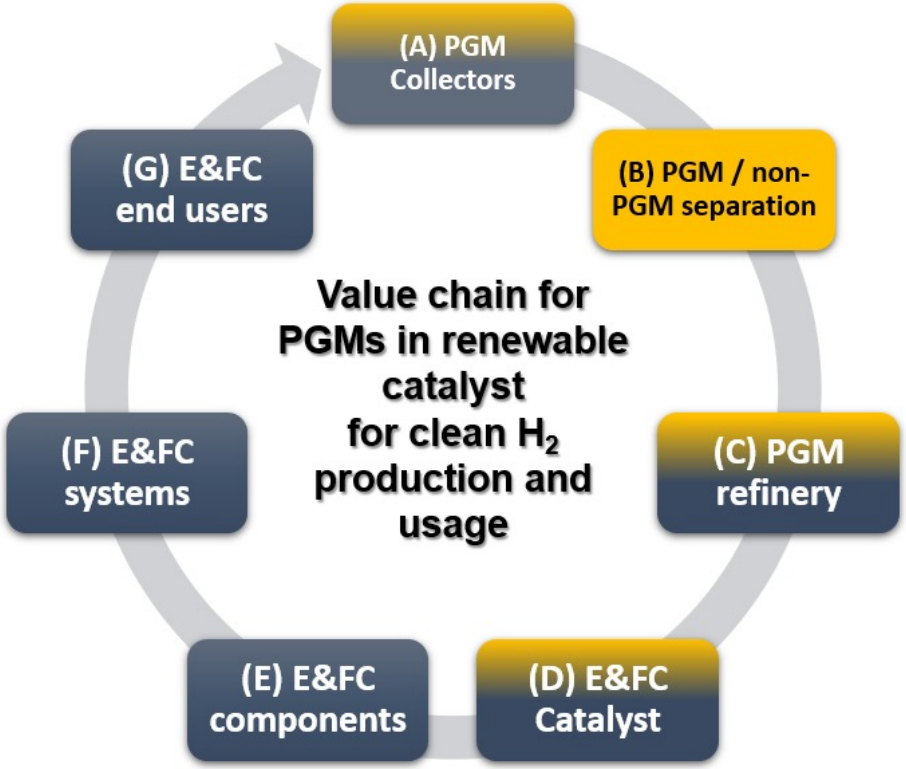
End-of-life PGM products → Activation → Extraction → Separation → Purification → High value PGM compound

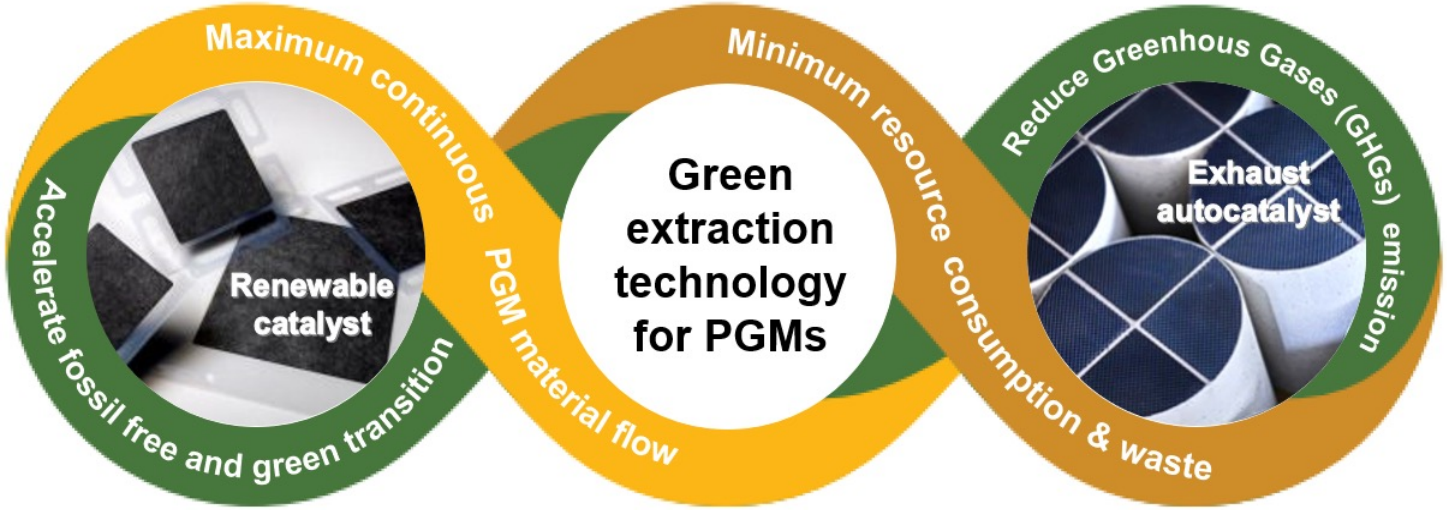
Efficiency up to 99%





Renewable energy catalyst electrolyzer and fuel cell (E&FC) value chain





An open-loop PGM circular economy between autocatalyst and renewable energy catalyst.

Danish Energy Agency

EUDP

The Difference

The existing and conventional method

Restriction of max 2% carbon content in recycle material – restricting silicon carbide based ceramic substrates.

Large volume-oriented process (20 tons per batch min.) – long cycle time. Centralized production – unsuitable for MEA processing.

"The existing and conventional method to recover PGM is pyrometallurgy. The large carbon content in Silicon carbide filters deteriorate the insulation in the high temperature kilns and is therefore restricted."

The novel recovery method

Capable of handling all ceramic substrates from EoL catalytic converters and catalysed particle filters.

Small batch-oriented process – short cycle time and localised production – less transport of material – suitable for MEA processing.

"The goal is to recover, recycle and reuse PGM from EoL diesel particle filters in the manufacturing of MEAs for sustainable power generating fuel cell systems and, in the future, to ensure that EoL MEAs also can be re-cycled in an environmentally friendly way."

Collaboration partners

SCIENCEVENTURES

Danish Energy Agency

EUDP

We work in accordance with UNs Sustainable Development Goal 12:

Responsible Consumption and Production

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