Viable recycling approaches to electrolyser stacks

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INTRODUCTION

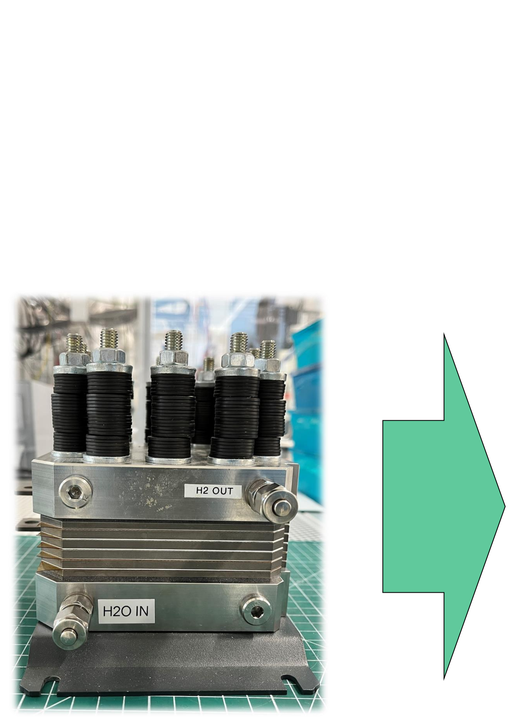
The transition to sustainable energy solutions is crucial in tackling the global environmental challenges posed by climate change and resource depletion. Among various alternative energy solutions, hydrogen production through proton exchange membrane (PEM) electrolysis plays a critical role in the green energy landscape. However, to maximize its environmental benefits, it is crucial to consider the lifecycle impacts of PEM electrolysers, particularly their recycling and end-of-life management. The ReCycle project aims to tackle this challenge by:

- Identifying sustainable pathways for recycling key components of the PEM electrolyser, such as porous transport layer (PTL) and bipolar plate (BPP).
- Integrating circular economy principles into PEM stack recycling to reduce environmental impact and enhancing recyclability across the value chain

With PEM recycling chain, disassembly plays a major role. Hence the need for suitable disassembly procedure. Currently, stacks are disassembled manually, but there is the need to integrate automated disassembly as production volume increases in the future.

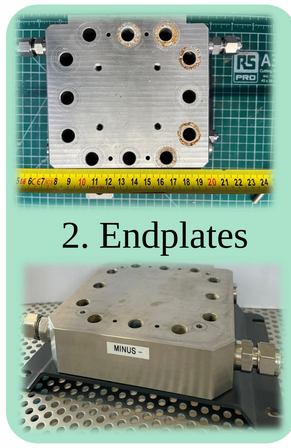
After disassembly, BPPs and PTLs are sent to their respective recycling processes. Titanium-based components follow simpler routes, whereas those with titanium-PGM (Platinum Group Metals) matrices require more complex recycling methods.

MANUAL STACK DISASSEMBLY



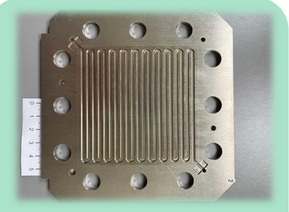
Electrolyser Stack

1. Fasteners

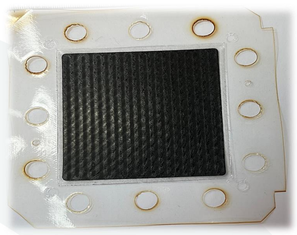


2. Endplates

3. Gaskets



4. Bipolar plates

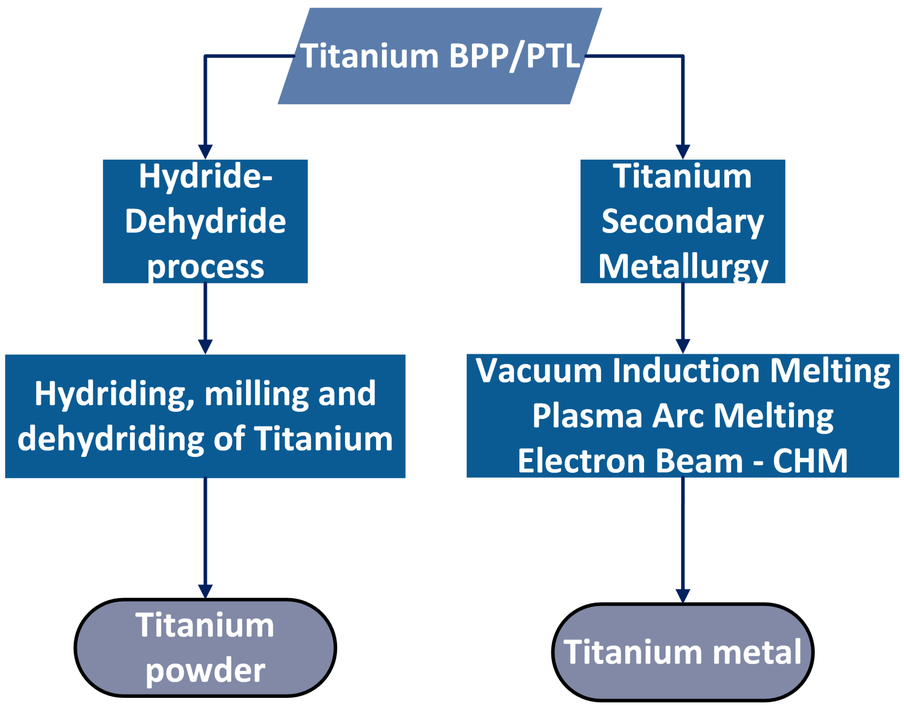


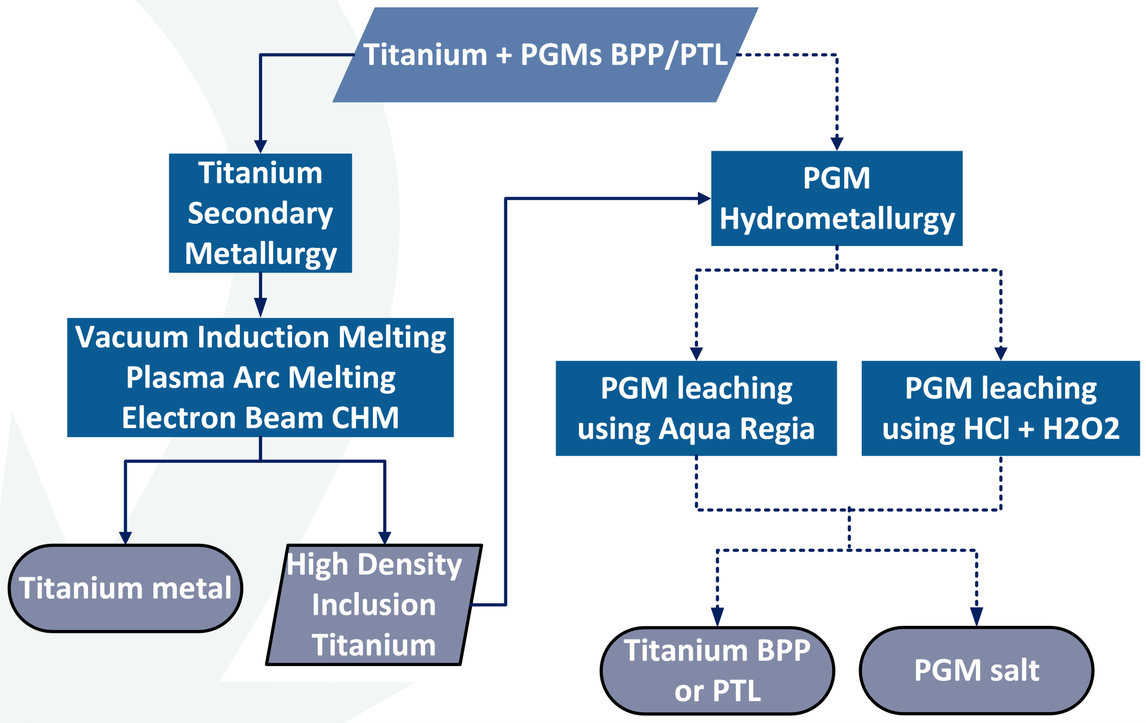
7. Catalyst coated membrane (CCM)

6. Porous transport layer (PTL)

5. Gas diffusion layer (GDL)

RECYCLING PROCESS ROADMAPS





OUTLOOK

- Plan leaching of titanium-PGM based PTL and BPP using aqua regia (HCl-HNO_3) and HCl-H_2O_2
- Optimize suitable recycling chain for stack components of interest
- Develop 2nd life scenarios and eco-design guideline for components.

PROJECT PARTNERS

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