FEATURE

BEST4HY

Key Features:

- **Project Focus:** Recycling for End-of-Life Hydrogen Technologies
- **Anna Marchisio Prosdocimo:** Business Development Manager at Hensel Recycling GmbH
- **Website:** www.best4hy-project.eu
- **Twitter:** @best4hy
- **LinkedIn:** BEST4Hy Project

Closing the Loop: The Recycling of End-of-Life Fuel Cells

Best4Hy is the European Commission's consortium tackling a problem that often goes overlooked in conversations about novel hydrogen technologies: end-of-life solutions. Here we explore the important work Best4Hy is doing and we introduce Hensel Recycling, one of the companies at the forefront of hydrogen fuel cell recycling.

At the Hydrogen Standard, we talk a lot about the newest technologies, those in development and those yet to come. Yet, for a product to be truly sustainable – even if it is, like hydrogen tech, designed to be green – attending to its creation and use is not enough. Rather, we need to understand what happens to that hydrogen technology once it's no longer usable.

For that, we need to talk about end-of-life strategies, a field to which Best4Hy have dedicated their work. The project sits within the HORIZON2020 funding programme, a plan of action by the European Commission to further smart, sustainable and inclusive growth and jobs.

Best4Hy is an international partnership developing tools for the recovery of critical raw materials from hydrogen technologies such as fuel cells. These include, among others, materials such as platinum group materials, rare earth elements, cobalt and nickel. They are all materials that can and should be used again. Because without closing the loop from cradle to grave in fuel cell technology, true sustainability is a distant dream.

Best4Hy is made up of nine different members, from six countries in Europe: Germany, France, Italy, Spain, Slovenia and Estonia. The consortium was established after successfully being approved by the EU Commission, submitting a joint proposition which covers the complexity stretching from re-using, recovering and re-manufacturing, to eco-designing, as well as LCA analysis (Life Cycle Assessment) of EoL fuel cells.

The consortium lasts as long as the project itself, which is set for 36 months starting January 2021. Some members, such as Hensel Recycling, have been involved in another similar EU project back in 2018, called HyTechCycling, which almost resembles the forefather of Best4Hy, though the composition of the members that made up the project was different.

In essence, Best4Hy focuses on the development and validation of existing and novel recycling processes for two key hydrogen fuel cell products: Proton Exchange Membrane Fuel Cells (PEMFC) and Solid Oxide Fuel Cells (SOFC). The Best4Hy

project is currently at laboratory scale (TRL 3 for SOFC and TRL 5 for PEMFC) and although more elements can be recovered from PEMFC and SOFC applications, such as nickel, copper, steel, iridium, other rare earth elements and graphite, focuses, as far as Hensel is concerned, on PEMFC, and the recovery of platinum and nafion, the electrolyte of the PEMFC, within the project.

However, one main question remains to be solved: which of all these materials can actually be recovered and reused? Due to the contamination of the bipolar plates in the fuel cell stack, over years of usage, it remains unclear from research to what degree materials recovered are commercially viable. But signs are good. The expectation is that around 95% of platinum, 70% of the ionomer and 30% of raw materials from SOFC will be recovered to a high enough quality for reuse to be possible. In the case of copper, steel and graphite, recycling rates are hoped to be even higher.
But it is still very early days. It is not expected that a significant stream of material will come back from the market for another 10 to 15 years. Meanwhile, questions of regulation need to be answered too. What will be the regulatory framework as fuel cell technology is rolled out? Who will be responsible for the implementation of the new rules? What will be the minimum quality standards? And, importantly, how and to which extent will Best4Hy be able to set the guidelines and influence this field of research?

The goal for now is to prove that it is feasible to recover both platinum and other strategic minerals from PEMFCs and SOFCs and reuse them on a laboratory scale. Once that's successful a wider project will be rolled out, but the European Commission and players involved want to take it step by step. Eventually, harmonisation in legislation and standards across various regions is the aim. But before then, clarity around safety and environmental issues (the management of toxic substances, or the risk of explosion) needs to be ensured.

As such, in the field of sustainable end-of-life solutions for the hydrogen industry, there's still much to consider. What's for sure is that Hensel Recycling and Best4Hy will be at the centre of those conversations for years to come. HS

Chart 1: Project Life-Cycle Overview