Hydrogen Europe Research

HYDROGEN EUROPE RESEARCH FEEDBACK EUROPEAN CRITICAL RAW MATERIALS ACT

Hydrogen Europe Research welcomes the consultation opened ahead of the publication of the European Critical Raw Materials Act proposal. Indeed, materials research is an important research field for fuel cells and hydrogen. Reducing the use of critical raw materials and improving the performances of technologies whilst reducing their overall costs are key challenges across the hydrogen value chain. Characterising the behaviour of current and novel materials in contact with hydrogen is relevant for many technologies: electrolysers, above- and underground hydrogen storage, gas grid components, hydrogen carriers, hydrogen refuelling stations, fuel cells, onboard hydrogen storage, hydrogen combustion, etc. Therefore **funding activities in materials characterisation and research should be a priority at European level.** The Clean Hydrogen Partnership has identified this topic as a Strategic Research Challenge for the storage of hydrogen, however further support will be required for other segments of the value chain to develop truly sustainable hydrogen technologies.

Whilst researchers are working on reducing and/or substituting critical raw materials in hydrogen technologies, **simultaneous efforts must be made to develop reusing, recovering and recycling of these materials in the EU**. Such processes will be essential to establish a sustainable and resilient hydrogen ecosystem in the EU.

Several critical raw materials are used **across the hydrogen value chain** and should be addressed in priority:

- **Platinum group metals (PGMs), notably iridium and palladium**

  Platinum is used for water electrolysis and fuel cells applications. There are six platinum-group metals, and they are especially relevant for technologies of the hydrogen value chain.
  Iridium (Ir) and Iridium Oxide (IrOx) are utilised as an oxygen evolution reaction (OER) catalyst at the anode of the Polymer electrolyte membrane (PEM) electrolyser, realised in form of a Ir-black from the manufacturing industry. Iridium today is the material providing the best tradeoff between activity and stability.
  Palladium is used both in fuel cells and electrolysers. About 47% of the palladium mining capacity is in Russia.

- **Rare earth metals, especially scandium and yttrium**

  Rare earth metals will play an essential role in the green transition. Among them, scandium and yttrium are important for the hydrogen value chain.

In 2017, approximately 3/4th of the scandium market was the solid oxide fuel cell (SOFC) sector. In SOFC, scandium-stabilised zirconia is used as an electrolyte. Unlike alternative materials, it allows lower operating temperatures and thus a longer lifetime of the SOFC. In most rare earth minerals, scandium occurs as a trace element. Due to this low concentration, scandium is only used as a by-product of the extraction processes of iron ore, rare earths, titanium, zirconium, uranium, cobalt, nickel and apatite. Compared to other metal markets, the scandium market is relatively small: the demand for scandium is estimated to be between 10 and 15 tonnes annually. The leading producers are China, the Philippines and Russia.

Recycling technologies for scandium were developed in EU-projects such as SCALE [1] but the technologies are not implemented in large scale yet.

Yttrium is important in the manufacturing of solid oxide fuel cells. Whereas now the market is not yet well developed, it is expected to grow, and tensions could be felt on the provisioning of yttrium in the long term.

Then, other raw materials, not specific to the hydrogen value chain should also be closely monitored. **Noncritical raw materials today may become critical in the mid- to long-term**. These materials are in high demand among different manufacturing sectors to enable the green transition. The case of **copper**, **silicon** and **graphite** is particularly relevant. Special attention should be paid to these materials.

Hydrogen Europe Research believes that policy measures to foster the recuperation of materials are necessary to improve the resilience of the value chain in hydrogen technology. This could include setting design requirements for products containing critical raw materials, in order to increase their ease of dismantling and recycling. Furthermore, technical solutions to recover materials from membranes and exhausted stacks will necessitate further research to develop viable options.

Hydrogen Europe Research remains available to reach out to experts in its network to provide further details on these questions and to support the needed evaluation of the state-of-the-art of CRMs supply and needs for the European hydrogen sector.

Hydrogen Europe Research is an international, non-profit association composed of more than 120 Universities and Research & Technology Organisations (RTO) from 27 countries in Europe and beyond. Our members are active within the European hydrogen and fuel cell sector.

[1] https://scaletechnology.eu/