Hidden powerhouses: The role of iridium and rare earth elements in the energy transition

Published 24 June 2024

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Key Takeaways

- Iridium is crucial for PEM electrolysers in green hydrogen production, and its extreme scarcity poses significant supply challenges as we scale up hydrogen production.
- Rare earth elements are essential for numerous high-tech and green energy applications, with their demand expected to increase dramatically due to their critical role in the clean energy transition.

The spotlight often falls on renewable technologies like solar panels and wind turbines in the quest for a sustainable and clean energy future. However, the true heroes behind these innovations are the materials that make them possible. Iridium and rare earth elements (REEs) play a crucial, albeit less talked about, role in this transition. Iridium, a member of the platinum group metals, is essential for the efficiency of hydrogen fuel cells and electrolysers. Meanwhile, rare earth elements, despite their name, are relatively abundant and are vital in manufacturing high-performance magnets, batteries, and other components critical to green technologies. Understanding the significance of these materials offers a deeper appreciation of the complexities and advancements driving the energy revolution. This blog explores the indispensable roles of iridium and REEs in shaping a cleaner, greener future.

Iridium

Iridium is critical in the hydrogen industry's drive towards a carbon-neutral future. As a key catalyst in polymer electrolyte membrane (PEM) electrolysers, iridium enables the efficient production of green hydrogen from water using renewable energy sources. However, its extreme scarcity – it’s only found in minute concentrations and primarily sourced as a by-product of platinum mining – presents significant supply challenges. According to the World Bank Group, the projected demand for iridium in PEM electrolysis could exceed current global production by 160% by the 2040s, creating a tightness in supply and strong demand for more mining.

To address these concerns, the industry is exploring ways to reduce iridium dependence, which, paradoxically, could still drive high demand due to the immense scale-up needed for global hydrogen production. Researchers are developing more efficient iridium-based catalysts and alternative materials to minimise iridium usage while maintaining performance. Innovations, such as the lattice-water-assisted mechanism developed by the University of Adelaide, boost the efficiency of iridium catalysts by 5-12%, highlighting

promising advancements. Additionally, efforts to create low-iridium catalysts show potential but require further validation in commercial settings. As the hydrogen sector expands, overcoming iridium supply constraints is crucial, ensuring that technological advancements keep pace with the ambitious targets for green hydrogen production.

Rare-earth elements

REEs, despite their name, are relatively abundant in the Earth's crust, but economically viable deposits are rare. This set of 17 elements includes those with unique chemical, electromagnetic, and magnetic properties, making them vital for numerous high-tech applications. Often referred to as the "vitamins" of modern technology, REEs enhance the performance, efficiency, and longevity of various products, from smartphones and semiconductors to defence equipment and green energy infrastructure. Their role in producing high-performance magnets is particularly crucial, as these magnets are essential components in electric vehicles (EVs) and wind turbines, enabling more efficient energy conversion and storage.

The importance of REEs in the energy transition cannot be overstated. The demand for these critical minerals is projected to skyrocket as the global economy shifts towards clean energy. In 2020, the World Bank suggested that producing critical minerals, including rare earths, could increase by nearly 500% by 2050 as demand for clean technologies forces new supply to come online. Neodymium-based magnets, which are integral to EV motors and wind turbines, illustrate this trend; the European Raw Materials Alliance forecasts that the demand for these magnets could rise from 5,000 tonnes in 2019 to as much as 70,000 tonnes by 2030.

According to the US Geological Survey (USGS), China has over 80% of the world’s capacity to process rare Earth concentrates or carbonates into materials manufacturers can use. With Western economies seeking to minimise their dependence on China for critical raw materials, countries like the US, Australia, Brazil, Vietnam, and others are expected to scale up their operations in the coming years.

Conclusion

Including less familiar but critically important materials like iridium and rare earth elements in a broad basket of energy transition commodities ensures capital is directed toward industries essential for developing necessary technologies. This strategy supports the advancement of key technologies and provides investors with a diversified and representative portfolio of the most crucial commodities for the energy transition.

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