

## Materials and systems for green hydrogen production and storage: challenges and opportunities

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Hydrogen offers the promise of clean, carbon-free energy. However, currently hydrogen is produced mostly from fossil fuels, resulting in more than 900 million tons of CO<sub>2</sub> emitted per year, according to the International Energy Agency.<sup>1</sup> Replacing fossil-fuel-based hydrogen with green hydrogen—that is produced by electrolysis of water with electricity from renewable energy sources—could cut these emissions to almost zero.

In this talk we will discuss selected research and perspectives of materials-related issues for the deployment of hydrogen-based technologies. Examples include a novel solid state photoelectrochemical (PEC) cell able to directly produce hydrogen from the atmosphere; and storage in solid-state host materials such as intermetallic compounds and their suitability for various applications. Real case demonstrations will be reported to discuss the relevance of hydrogen storage toward a green energy transition.

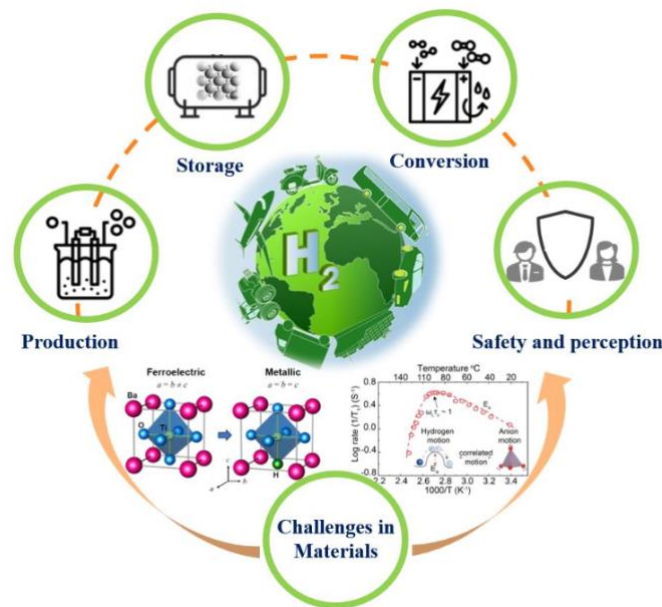


Figure. Green hydrogen pathways to scale adoption.<sup>2</sup>

<sup>1</sup> International Energy Agency, Global Hydrogen Review 2023 (2023). <https://www.iea.org/reports/global-hydrogen-review-2023>

<sup>2</sup> S. Sartori, R. O’Hayre, Z. Shao, MRS Bulletin (2024), doi:10.1557/s43577-024-00719-4.