Rapid, Low-Cost Hydrogen Production Using Magnets

Problem Statement: Electrolysis of water has been a significant contender for the sustainable production of green hydrogen. However, the demand to enhance the energy efficiency of the electrolysis and minimise the use of expensive catalysts without affecting the rate of hydrogen production is gaining increased relevance, especially with India announcing the National green hydrogen initiative. Thus, the holy grail of achieving green hydrogen through electrolysis lies in achieving a high hydrogen production rate at lower energy and material costs, which the team envisages.

Uniqueness of the Solution: The solution demonstrated at the lab scale involves two significant innovations: introducing a weak external magnetic field (<500 mT, typical of a fridge magnet) to the electrolytic chamber; and the use of earth-abundant metal oxides (cobalt, nickel and their combinations) supported on a nanostructured hard-carbon matrix as a catalyst. These innovations synergistically combine to decrease energy consumption by 20% and increase the hydrogen production rate by three times. Based on this, the cost of hydrogen produced using this technology would reduce to INR 250/kg, compared to the current INR 500/kg cost for electrolytic hydrogen. Further, it is expected to become cost-competitive with hydrogen from steam-reforming (INR 150/kg) with large-scale adaptability and commercialisation.

Current Status of Technology: The team has successfully demonstrated a lab-scale proof of concept and now solicits support from the industry for prototyping and commercial validation.

Societal Impact: This technology can make India a leader in green hydrogen production. It is expected to be of significant interest for steel industries that mainly utilise hydrogen from polluting, non-renewable sources.

Patent(s): Filed

Relevant Industries: Hydrogen Storage, Electric Vehicles, Clean Energy, Renewables.

Faculty: Prof. Chandramouli Subramaniam, Chemistry.