

A Separator Electrode Assembly with Novel Separator and a Bifunctional Catalyst Material

IITM Technology Available for Licensing

Problem Statement

- In the water electrolysis technology, the prior electrolyzers use **membranes/separators** & DI water for operation. These membranes or separators are expensive and use of DI water results in depletion of water source.
- So, there is a demand to use natural water resources such as **seawater or ground water**.
- The major challenges of sea water electrolysis observed in many prior arts are **chlorine corrosion, impurities & multiple ions present in the water**.
- There are also **several ion adsorption** on the cathode & anode surface further make both Oxygen Evolution Reaction (OER) & Hydrogen Evolution Reaction (HER) **sluggish**.
- Hence, there is a requirement to introduce **novel catalysts & separator** to mitigate above challenges & other issues.

Technology Category/ Market

Technology: A separator & a Bifunctional catalyst material used in water electrolysis technology;

Industry: Green Energy/Clean Energy, Electro-Chemical; **Applications:** H₂ production, Power plant, Electronics & PVs, Steel Plants, Energy storage;

Market: The global water electrolysis market size is projected to be valued **\$9.318B** by **2030**, at a **CAGR** of **6.0%** during forecast period (2022-2030).

Technology

- Present invention describes a **separator electrode assembly (SEA)** for **water electrolyzer** (FIG. 1).
- Further, the present invention explains about a **method** of preparing **bifunctional** catalyst material.

Images

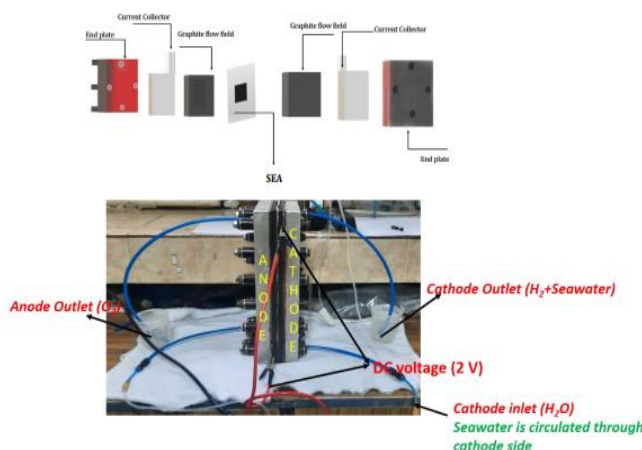


Figure 1: Separator electrode assembly (SEA) for water electrolyzer

- Present invention provides a separator electrode assembly for a **water electrolyzer** wherein the assembly comprises a **separator** sandwiched between an anode & a cathode.
- The separator is a **cellulose based material** in combination with **synthetic polymer-based material**.
- The anode and cathode are formed by coating a **bifunctional catalyst material** on a non-metal substrate.

Intellectual Property

IITM IDF Ref.2501;

Patent Application No: 202341034478

TRL (Technology Readiness Level)

TRL- 3/4, Proof of Concept ready & validated

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Images

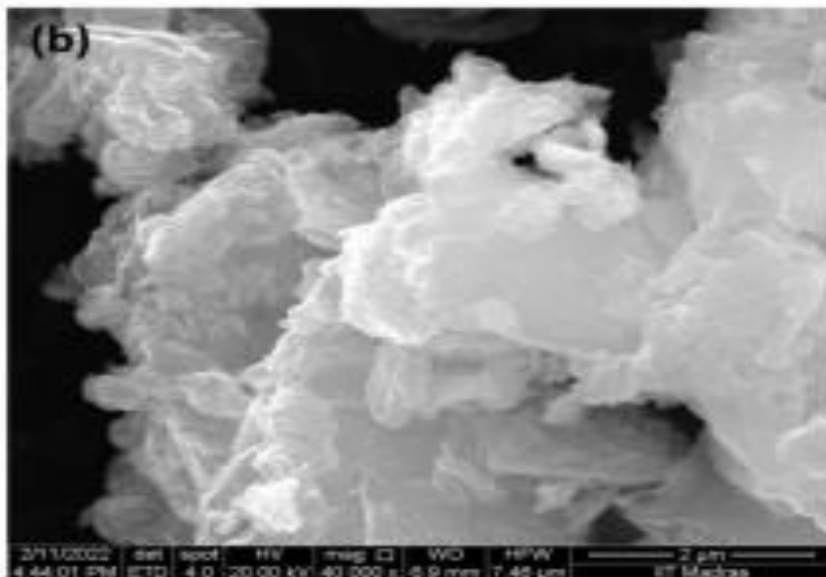


Figure 2(b): SEM image of bifunctional catalyst material

Key Features / Value Proposition

❖ Technical Perspective:

1. Present separator electrode assembly is a **zero-gap, single flow cell membrane-less separator electrode assembly** for the water electrolyzer.
2. The catalyst material is employed in Hydrogen Evolution Reaction (**HER**), Oxygen Evolution Reaction (**OER**), Oxygen Reduction Reaction (**ORR**), **Alkaline fuel cell**, battery, or Electrochemical sensor.
3. **Selectively produce oxygen** at the anode over hypochlorite & hydrogen production at the cathode on electrolysis of sea water.
4. The **bifunctional** catalyst material is a **transition metal-metal oxide-carbon nanocomposite**.
5. The **assembly** electrolyzes **natural water, selected from tap water, ground water, or sea water**.

❖ Industrial Perspective:

1. Present patent discloses **separator electrode assembly** which is **cost effective & simple** in design for scale up production.
2. The process of preparing bifunctional catalyst material is **sustainable & cost-effective**.

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Images & Experimental Results



Figure 3: Illustrates Lab-scale testing of seawater electrolysis by the anode and cathode synthesized by bifunctional catalyst materials.

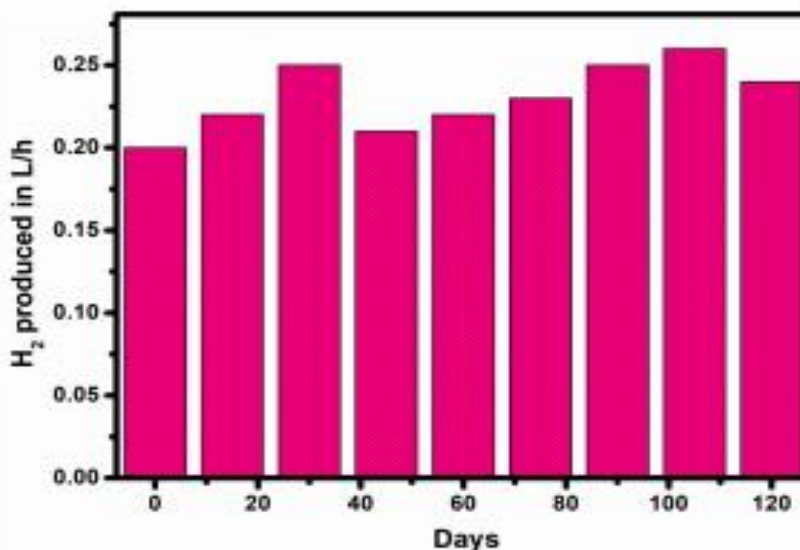


Figure 4: Illustrates H₂ produced over 120 days from the separator electrode assembly of active area 16 cm².

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