Iron Ion Rechargeable Battery And Method for Making Thereof

IITM Technology Available for Licensing

Problem Statement

- Current battery technologies, **e.g., Lithium ion; Ni-Fe batteries**, **face limitations** in terms of manufacturing cost, resource availability, high self-discharge rate, lower energy density & lower specific power, **especially for large-scale applications.**
- In the search of a **high-performance, cost-effective alternatives** to the **lithium-ion batteries** are **constrained** by the **limited options** for **divalent ions.**
- The increasing need for sustainable, cost-efficient, and eco-friendly energy storage solutions, driven by **renewable energy and electric vehicles**, highlights the **urgency** to **overcome current battery limitations**.
- Hence, there is a need of present patent disclosure of material, design, and manufacturing processes to surpass the above cited limitations and offers a economical & sustainable solution to store energy.

Technology Category/ Market

Energy, Energy Storage & Renewable Energy

Industry: Battery and Energy Storage

Applications: Portable electronic devices, e-vehicles, Renewable energy systems, Grid energy storage

Market: The Global Rechargeable Battery Market is valued at **$111.72 B** in **2022** and is projected to reach a value of **$183.53 B** by **2030** at **6.4% CAGR** over the forecasted period (2022-2030).

Technology

The instant technology discloses the **Iron Ion Rechargeable Battery And Method for Making Thereof for efficient energy storage**. It comprises:

Anode:

- Iron or iron-based materials like mild steel are used as the anode (the negative electrode) in these batteries.

Cathode:

- The cathode (the positive electrode) is typically a layered metal oxide coated on a current collector. This oxide acts as a host for intercalating Fe2+ ions, allowing them to move in and out of cathode during charging and discharging.

Electrolyte:

- An iron-ion conducting electrolyte is used to transport Fe2+ ions between the anode and the cathode. enables electric current flow.

Separator:

- An electrode separator membrane is placed between the anode and the cathode to prevent direct contact while allowing ion passage.

Slurry Coating:

- The cathode is coated with a slurry containing a conducting additive (often carbon-based materials like carbon nanotubes) & binding agent (e.g., poly-vinylidene fluoride).

These components help with electron transport and electrode material adhesion. During battery operation:

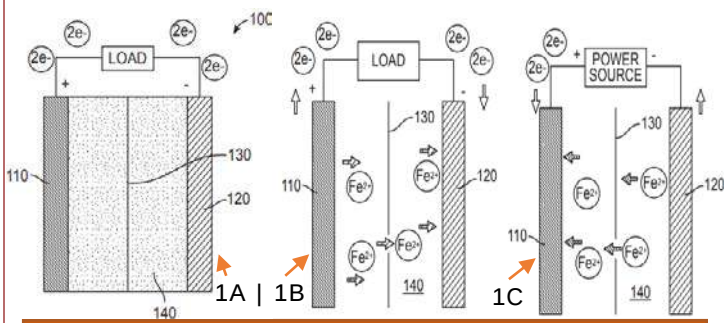
Charging:

- When the battery is being charged, Fe2+ ions are electroplated onto the anode, and Fe2+ ions in the cathode migrate through the electrolyte to the anode. Electrons flow through the external circuit, allowing the battery to store energy.

Discharging:

- During discharging, Fe2+ ions are stripped from the anode, migrate through the electrolyte to the cathode, and intercalate into the layered metal oxide. This movement of ions and electrons provides electrical power to external devices.

FIG. 1A shows a schematic view of Iron ion rechargeable battery; FIG. 1B shows ion transport during discharging and FIG. 1C illustrates the ion transport during charging.



Intellectual Property

IITM IDF Ref.: 1840 | IP Grant No.: 349153
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TRL (Technology Readiness Level)

TRL- 3: Proof of Concept

Research Lab

Prof. Ramaprabhu S
Department of Physics

Key Features / Value Proposition

- ***User Perspective:*** Iron-ion batteries provide a cost-effective, eco-friendly and Sustainable energy storage solution with competitive performance.
- ***Technical Perspective:*** Divalent iron-ions boost energy density, and efficient electrode and electrolyte design ensures reliable performance.
- ***Industrial Perspective:*** Iron-ion batteries offer profitable and sustainable production, aligning with market demands for eco-friendly energy storage.

CONTACT US
Dr. Dara Ajay, Head
Technology Transfer Office,
IPM Cell- IC&SR, IIT Madras

IITM TTO Website:
https://ipm.icsr.in/ipm/

Email: smipm-icsr@icsrpis.iitm.ac.in
sm-marketing@imail.iitm.ac.in
Phone: +91-44-2257 9756/ 9719