Temperature Tolerant and Highly Cyclable all-oxynitride-based Solid State Asymmetric Supercapacitors

IITM Technology Available for Licensing

Problem Statement

- Traditional supercapacitors uses **carbon-based materials with limitations in specific capacitance**, while those based on metal oxides or conducting polymers offer **high capacitance but lack cyclic stability.**
- Challenges to **maintain performance** across a wide temperature range is faced by it.
- Though we have addressed **asymmetric supercapacitors**, there is a gap in disclosing a super-capacitor with **both electrodes as oxynitride electrodes** and specifically emphasizing high-temperature tolerance.
- **Temperature-tolerant** supercapacitors with **extended cycle life** are lacking in market.
- Hence, there is a need to develop a **highly cyclable and temperature-tolerant all-oxynitride-based solid-state asymmetric supercapacitors**, for filling the technical gap in the current market space.

Technology Category/ Market

Categories: Energy, Energy Storage & Renewable Energy | Electronics & Circuits

Industry: Electronics Industry

Applications: Portable Electronics, Wearable Technology, Automotive Sector, Renewable Energy Systems, Industrial Automation

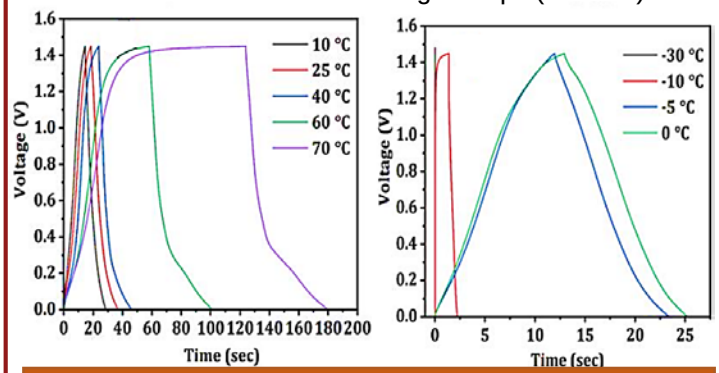
Market: The global Supercapacitors market size was valued at **US$ 5.54 B in 2022** and is expected to reach **US$ 24.03 B** growing at **23.3% CAGR** from **2023 to 2029.**

Technology

The invention presents an **a highly cyclable & temperature-tolerant all-oxynitride-based solid-state asymmetric supercapacitor** with electrodes made of cerium oxynitride and chromium oxynitride.

The invention introduces a novel **method** for preparing **oxynitride nanoparticles**, involving the use of urea in a solution of cerium or chromium salt in ethanol. The **resulting nanoparticles** are used as electrode materials.

FIG 1 a & b shows GCD curves at different temperatures. It proves the enhancement of areal capacitance with an increase in Tepm. (70) and device ceases at freezing Temp. (-30 oC).



Key Features / Value Proposition

❖**User Perspective:**

- Devices equipped with it ensure **longer lifespan and consistent performance.**
- Enables rapid charging & higher energy density, **providing quick and lasting device usage**.

❖**Industrial Perspective:**

- Offers an **advanced energy storage solution**, fostering innovation in energy systems.
- **Lowers maintenance costs** & ensures reliable operations across various conditions.
- **Offers superior energy storage capabilities.**

❖**Technical Perspective:**

- Cyclic stability greater than **20% capacitance degradation** after **>105 cycles**.
- Rate capability of **72.92%** capacitance retention at **100 mV s-1**.
- **Temperature-based stability (-30 to 70 oC).**

Intellectual Property

IITM IDF No: 2263
IP No: 461057 (**Granted**)

TRL (Technology Readiness Level)

TRL– 4; Experimentally validated in lab.

Research Lab

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