Aluminium-ion Battery

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The Centre for Nano and Soft Matter Sciences (**CeNS**)**, Bengaluru**, have developed a flexible aqueous **aluminum-ion battery** as a safe and **sustainable alternative to lithium-ion batteries** commonly used in phones, laptops, electric vehicles, etc.

Aluminium-ion Battery

- **Material Used:** The battery uses **aluminum**, one of the most abundant and eco-friendly metals, combined with a **water-based electrolyte**, making it **cheaper, non-explosive, and environmentally safe.**
- **Components**: It consists of a **copper hexacyanoferrate (CuHCFe) cathode (Positive electrode)** pre-filled with aluminum ions and a **molybdenum trioxide (MoO_3) anode (negative electrode).**
- **Performance: The battery remains capable even after 150 charge–discharge cycles, and can continuously power devices while being folded.**
    - It is designed to be flexible enough to bend or fold like paper without losing performance.
- **Applications:** Opens up avenues for **flexible smartphones, wearable devices and safer electric vehicles**.
    - This development positions India at the forefront of **sustainable and next-generation energy storage** solutions aligned with global climate and environmental goals.
- **Challenges: Slow diffusion of Al^{3+} ions and potential structural collapse of materials like graphite limit cycle stability.**
    - Aluminum anodes suffer from corrosion, **which can impact the longevity** of the battery.

Lithium-ion Battery

- It is a **rechargeable battery** in which **lithium ions** travel between a **negative electrode (graphite)** and a **positive electrode (Li transitional metal oxides)** via a non-aqueous electrolyte during the charging and discharging process.
- It stores **more energy in a compact form** and offers **longer cycles between charges**.
- Unlike older lead-acid batteries, it is **lighter and uses less toxic Li** and carbon electrodes.

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