Lightweight Carbon Foam

Why in News

Recently, scientists (including a recipient of the INSPIRE Faculty award) from the CSIR-Advanced Materials and Processes Research Institute (Bhopal) have developed **the 'lightweight carbon foam'** which has the potential to **replace lead grid in lead-acid batteries.**

Background

- Currently, the large-scale energy-storage sector is dominated by **Lithium-ion (Li-ion) batteries**, because of their **higher energy density and long cycle life.**
  - Energy density is the amount of energy that can be stored in a given mass of a substance or system, i.e. a measure of storage of energy.
- However, there are some **concerns** regarding Li-ion batteries, such as safety risk, limited resource supply, high cost, and lack of recycling infrastructure.
- As a result, **lead-acid batteries are still one of the most reliable, economical, and environmentally friendly options.**
  - The Lead-acid battery is one of the **oldest types of rechargeable batteries** and was invented in **1859 by the French physicist Gaston Plante.**
  - However, electrodes in the lead-acid batteries **suffer** from the problem of **heavyweight, corrosion, poor thermal stability, and diffusion of electrolytes in one dimension, which ultimately affects the output power.**
- The above issues necessitated the development of **an alternative battery system** with lower environmental concerns, economic and **higher energy density.**
- Thus, currently developed lightweight carbon foam **can replace the lead-acid batteries** as the foam is **highly resistive to corrosion,** has **good electrical and thermal conductivity** with **high surface area.**

Key Points

- **Properties:**
    - The developed lightweight carbon foam has **very less density and high porosity.**
    - It also has a **good mechanical strength** and is **insoluble in water.**
- **Uses:**

  It can also be useful for heat sinks in power electronics, electromagnetic interference shielding in aerospace, hydrogen storage, electrodes for lead-acid batteries and water purification systems.

  In the case of water purification systems it is cost-effective for the **removal of arsenic, oil, and other metals from contaminated water.**
- **Benefits:**
    - These carbon foams are non-toxic, easy to fabricate and affordable.
    - The raw material for the fabrication of carbon foam is easily available and there is no requirement of any costly equipment for the fabrication of carbon foam and filtration.
    - Such materials can be safely used in remote areas where power supply is scarce.
- **Other Related Development:**

  Recently, a group of researchers (including a recipient of the INSPIRE Faculty Award) have also made significant achievements in developing **nanomaterials based supercapacitors** to achieve **high energy density** and **power density of supercapacitors.**

Source:PIB