

Superconductivity

Terms to know

- Superconductivity is a set of physical properties observed in certain materials where electrical resistance vanishes.
- Coulomb repulsion -The repulsive force between two positive or two negative charges,

Recent study

- In 1911, Dutch physicist Heike Kamerlingh Onnes discovered superconductivity in mercury.
- He found that at a very low temperature, called the threshold temperature, solid mercury offers no resistance to the flow of electric current.
- The BCS theory Scientists later classified mercury as a conventional superconductor because its superconductivity could be explained by the concepts of Bardeen -Cooper- Schrieffer (BCS) theory.
- While scientists have used the BCS theory to explain superconductivity in various materials, they have never fully understood how it operates in mercury the oldest superconductor.
- In BCS superconductors, vibrational energy released by the grid of atoms

encourages electrons to pair up, forming so-called Cooper pairs.

- These Copper pairs can move like water in a stream, facing no resistance to their flow, below a threshold temperature.

Coulomb repulsion

- One electron in each pair in mercury occupied a higher energy level than the other.
- This detail reportedly lowered the Coulomb repulsion (like charges repel) between them and nurtured superconductivity.
- Thus, the group has explained how mercury becomes a superconductor below its threshold temperature.

THE HINDU

Floatovoltaics'

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- Covering 10% of the world's hydropower reservoirs with 'floatovoltaics' would install electrical capacity equivalent to that provided by all electricity-generating fossil fuel plants in operation worldwide.
- Floating solar panels have benefits: the water's cooling effect makes them more efficient than land-based ones;

- They don't interfere with desert ecosystems, and they keep precious water from evaporating.
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THE HINDU

Viologen-unit grafted organic-framework (iVOFm)

- A limitless supply of fresh water exists in the form of water vapour above Earth's oceans, yet remains untapped.
 - A new study from the University of Illinois Urbana- Champaign suggests harvesting oceanic water vapour as a solution to limited supplies of fresh water in various locations globally.
 - The researchers evaluated 14 water-stressed locations for the feasibility of a hypothetical structure capable of capturing water vapour and condensing it into fresh water.
- To tackle this, water pollution at the Indian Institute of Science Education and Research (IISER), Pune came up with a custom -designed unique molecular sponge -like material macro/microporous ionic organic framework which can swiftly clean polluted water by soaking up sinister contaminants.

Carcinogenic pollutants

- Systematic studies have identified various organic (organic dyes, antibiotics, pesticides, etc.) as well as inorganic toxic pollutants such as iodides, and oxo-pollutants like perrhenate that are carcinogenic in freshwater sources and can pose a direct threat to humanity and living organisms.
- In general, commonly utilized sorbent materials often trap these pollutants through an ion exchange strategy to purify water but suffer from poor kinetics and specificity.
- Sorbents are insoluble materials or mixtures of materials used to recover liquids through the mechanism of absorption, adsorption, or both
- To mitigate this issue, our group prepared a newly engineered material called viologen-unit grafted organic- framework (iVOFm).

- The material employs an amalgamation of electrostatics driven ion- exchange combined with Nanometer-sized macropores and specific binding sites for the targeted pollutants.
- The size and number of tunable macropores along with the strong electrostatic interaction of iVOFm can quickly remove various toxic pollutants from water.

THE HINDU

Alzheimer's disease

- Research has shown that the seeds of Alzheimer's are planted years earlier, long before the cognitive impairments surface that make a diagnosis possible.
- Those seeds are amyloid beta proteins that misfold and clump together, forming small aggregates called oligomers.
- Over time, through a process scientists are still trying to understand, those 'toxic' oligomers of amyloid beta are thought to develop into Alzheimer's.
- A team led by researchers at the University of Washington has developed a laboratory test that can measure levels of amyloid beta oligomers in blood samples.

THE HINDU
