Perovskite Solar Cells

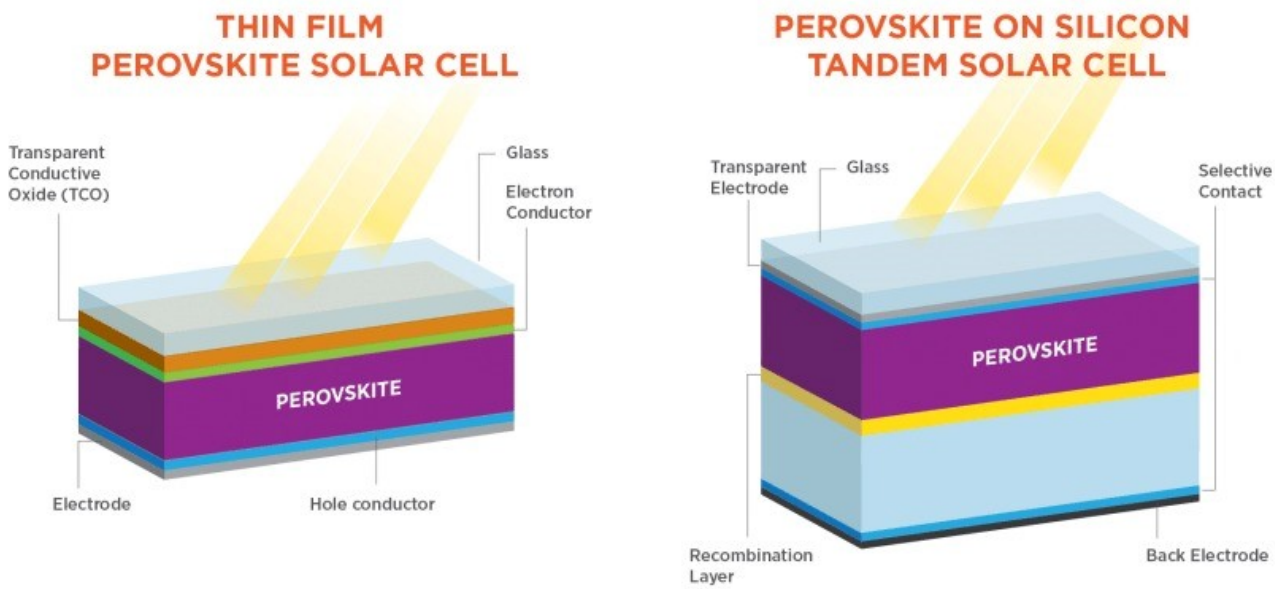
Prelims – *Current events of national Importance | General Science.*

Mains (GS III) – *Science and Technology- developments and their applications and effects in everyday life.*

Why in news?

Recently scientists have developed a water-based recycling solution for perovskite solar cells.

- **Perovskite solar cells** – A perovskite solar cell is a third-generation solar cell that employs a *metal halide perovskite* compound as a light absorber.
- Perovskite solar cells are made up of multiple layers.
- The perovskite layer can conduct and transport charges is *sandwiched between metal electrodes and glass sheets*.
- They are a class of semiconductor materials are known for their *unique optical, superconductivity and electronic properties*.



Metal halide perovskites (MHPs) were first discovered by Russian mineralogist L. A. Perovski.

- **Advantages** – They are cheaper to produce than silicon-based solar panels and offer higher efficiency in energy conversion.
- **Disadvantages** – But they *contain toxic elements* like lead that require careful disposal and have *shorter lifespans* than traditional solar panels.

- Perovskite materials are ***extremely unstable*** towards ambient (humidity and oxygen) conditions that restrict their commercialisation.
- **Recycling** – The components of the solar cells are recycled to minimize the emission and lower cost associated with solar energy generation.
- By recycling the components of a perovskite solar cell can be used for as long as possible, to minimise waste and promoting circular economy.
- Currently they are recycled using the ***toxic organic solvents***.

The new water-based recycling process

- Dissolving and recycling the lead-containing perovskite layer in water was a major challenge to overcome.
- For this, the scientists added three key salts to help in the recycling process.
- **Sodium acetate** –It binds with lead ions in solar cells to form ***lead acetate***, which is easily soluble in water.
- **Sodium iodide** – It helps in *repairing and restoring* degraded perovskite compounds.
- **Hypophosphorous acid** – It acts as a *long-term stabilizer*.

Stabilizer is a substance that either prevents or slows down reactions, thus enhancing the stability of a system.

- **Ethanol and ethyl acetate solutions** – They are also used to dissolve other components.
- **Results of the new method** – Scientists recovered approximately 99% of different layers after multiple recycling rounds.
- Recycled materials-maintained efficiency comparable to fresh materials even after five recycling cycles.

Quick facts
Carbon-based perovskite solar cells • Indian scientists have indigenously developed highly stable, low-cost Carbon-based perovskite solar cells with superior thermal and moisture stability. • The sensitivity of perovskite materials toward humidity and thermal stress is a major obstacle for practical implementation. • Carbon-based perovskite solar cells (CPSCs) have been successful in minimizing device stability issues. • It also reduces the fabrication costs.

Reference

The Hindu| Perovskite Solar Cells