New technology for stable, tunable and scalable white LEDs

Prelims: *Current events of National and International Importance| Science and Technology*

Why in News?

Researchers at the Centre for Nano and Soft Matter Sciences (CeNS) in Bengaluru and IIT Delhi developed a white LED technology using halide perovskite nanocrystals that prevents color blurring while allowing tunable white shades and scalable fabrication.

- Traditional commercial white LEDs rely on costly rare-earth elements, high-temperature manufacturing, and fixed color tones.

How the Technology Works?

- **Dual-protection barrier**– The team used lead selenide to reduce halide vacancies on the nanocrystal surface, limiting ion movement without losing brightness or color purity.
- **Ultrathin alumina coating**– Atomic layer deposition (ALD) added a 5–6 nanometer transparent aluminum oxide layer to block ions from diffusing between adjacent color-emitting layers.
- **Scalable manufacturing-** Using spray coating and micropatterning, the researchers built multilayer white LEDs on rigid glass and flexible plastic (PET) substrates.

Key Capabilities and Limitations

- **Tunability and stability**– Changing the electrical current shifts the white light from dimmer to warmer shades, while devices maintained stable white emission during 24 hours of continuous operation and heating/cooling cycles.
- **Applications-** Potential uses include cost-effective home and smartphone lighting, displays, and flexible lighting systems, as highlighted by DD News.
- **Remaining challenge**– Further work is needed to address lead toxicity and find eco-friendly alternatives before commercial adoption.

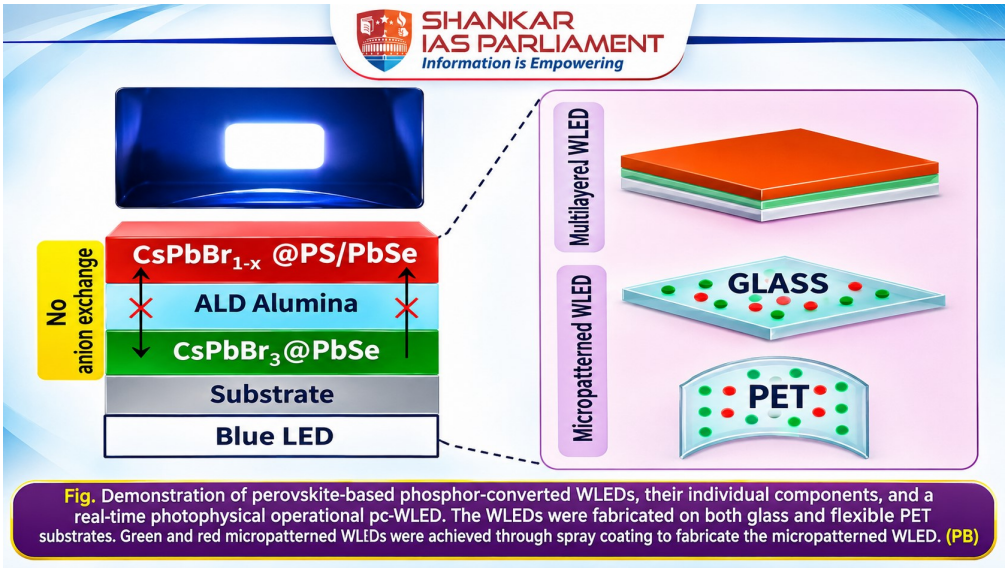

Fig. Demonstration of perovskite-based phosphor-converted WLEDs, their individual components, and a real-time photophysical operational pc-WLED. The WLEDs were fabricated on both glass and flexible PET substrates. Green and red micropatterned WLEDs were achieved through spray coating to fabricate the micropatterned WLED. (PB)

Reference

[DD News| New technology for stable, tunable and scalable white LEDs]