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Extremely Efficient and Bright Near-infrared Perovskite Light-emitting Diodes

NIR PeLEDs with ~29% EQE and high radiance for sensing, LiDAR, biomedical, and night-vision applications.

Researchers at Purdue University have developed a near-infrared (NIR) perovskite light emitting diode (PeLED) with exceptional brightness and efficiency. Metal halide perovskite materials are highly favorable to revolutionize LED technologies, as they possess remarkable optoelectronic and charge transportation properties. When applied in the NIR region, perovskite LEDs demonstrate superior performance to existing counterparts. However, PeLEDs still lag behind costly yet high performing epitaxial III-V semiconductors. The pursuit for NIR PeLEDs with exceptional performance remains a vigorous focus of research.

The technology developed by Purdue Researchers demonstrates the most efficient NIR PeLEDs to date, attaining exceptional performance at high current densities. The NIR PeLEDs help the semiconductor industry develop solid-state lighting, display, and biosensors by reducing the manufacturing cost and improving device performance. This technology offers enhanced light-outcoupling, reduced defect density, and accelerated radiative recombination. By suppressing defect formation through intermediate phase-assisted crystallization, this technology is significantly advantageous over its competition.

Technology Validation:

Through a holistic approach encompassing enhancements in outcoupling efficiency, defect passivation, and rapid radiative recombination, the NIR PeLEDs showcased a boosted device performance with an outstanding peak external quantum efficiency (EQE) of 29% (average 26.3%) and a maximum radiance of 929 W sr^-1 m^-2.

Advantages:

-Attains exceptional performance at high current densities

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Category
Chemicals & Advanced Materials/Specialty & Performance Chemicals
Chemicals & Advanced Materials/Materials Processing & Manufacturing Technologies

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-Reduces manufacturing costs

-Possesses enhanced light-outcoupling, reduced defect density, and accelerated radiative recombination

Applications:

-Semiconductor industry

-Biomedical industry

-Sensing

-Night vision

-LIDAR

TRL: 3

Intellectual Property:

Provisional-Gov. Funding, 2024-01-22, United States

Utility-Gov. Funding, 2025-01-22, United States

Keywords: magnetic architectures, magnetic nanostructures, magnetic tunnel junction (MTJ), Materials and Manufacturing, Materials Engineering, Micro & Nanotechnologies, micro and nanotechnologies, nanomagnets, spin switch, spin torque current, spin valve (SV)