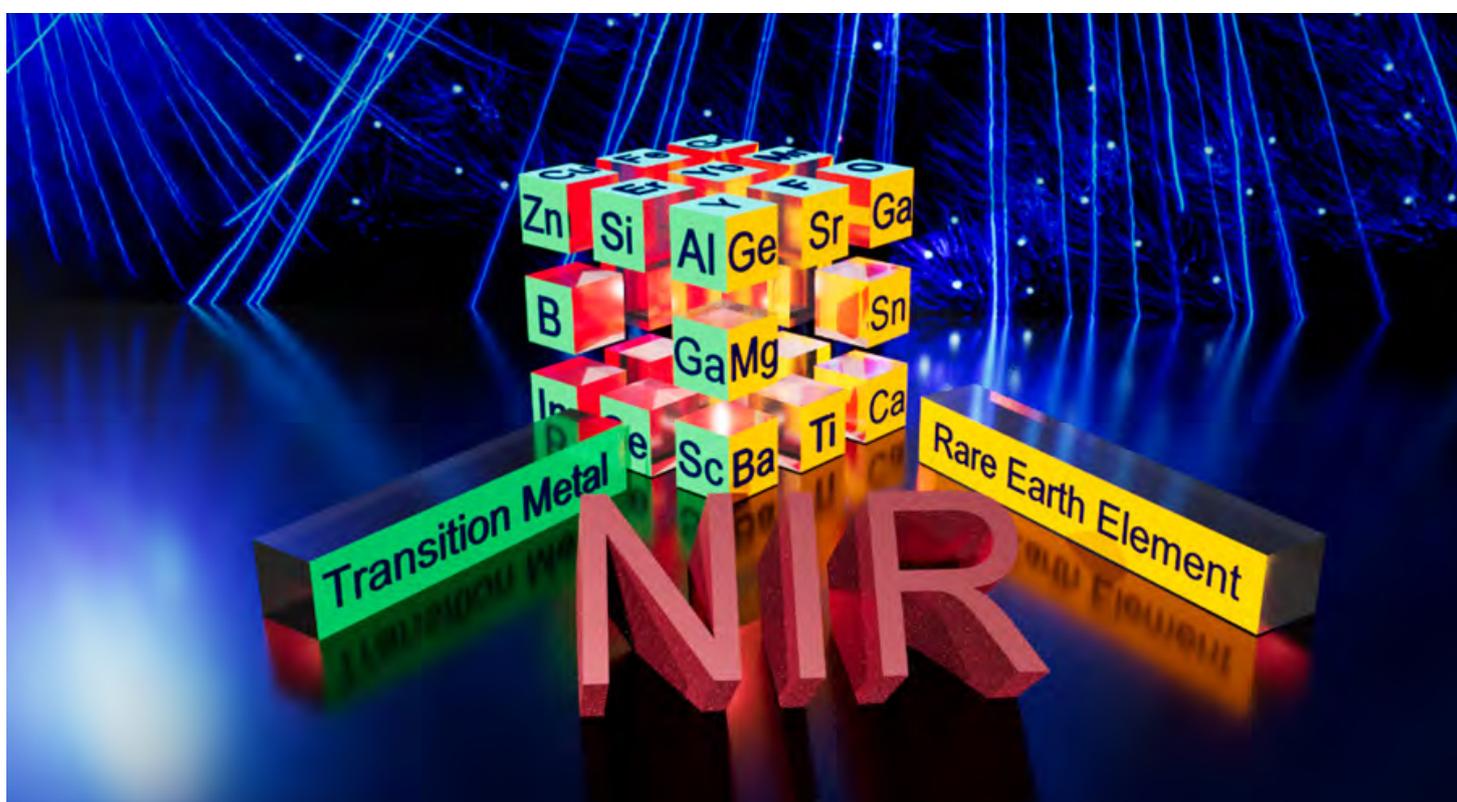


ACHIEVEMENTS

NTU Chemistry Team Publishes Landmark Review on Near-Infrared Phosphors, Advancing Next-Generation Optical Applications

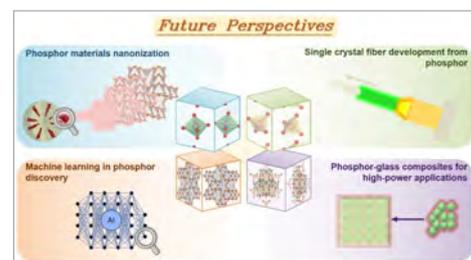
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Schematic illustration of phosphor structural design concepts, revealing the synergistic relationship between host lattices and activator ions.

In recent years, rapid advances in optoelectronic and biomedical technologies have elevated near-infrared (NIR) light to a pivotal role in next-generation optical applications. According to the international standard ISO 20473, the NIR region is subdivided—based on biological penetration depth—into three spectral windows: NIR-I (650–950 nm), NIR-II (1000–1350 nm), and NIR-III (1500–1850 nm). These spectral ranges are critically important for applications ranging from plant lighting, security surveillance, and blood oxygen monitoring to spectroscopic analysis.

Notably, short-wave infrared (SWIR) light in the 900–1700 nm range offers distinct advantages, including reduced light scattering, deeper tissue penetration,



Outlook for development of near-infrared phosphor materials, including phosphor nanostructuring for biomedical applications, single-crystal fiber development, AI-assisted structural design, and phosphor-glass composites for high-power applications.

and superior biocompatibility. These properties provide for clearer biomedical imaging and highly sensitive molecular recognition. However, today's commercially available NIR light sources—such as InGaAs LEDs and tungsten lamps—tend to suffer from narrow emission bandwidths or bulky form factors, limiting their suitability for use in portable devices and broadband analytical applications. Consequently, the development of broadband, high-efficiency, and stable near-infrared phosphor-converted light-emitting diodes (NIR pc-LEDs) has emerged as a major research focus across academia and industry.



Click or Scan the QR code to read the full article in *Progress in Materials Science*.

Recently, Distinguished Professor Ru-Shi Liu of the Department of Chemistry, College of Science, National Taiwan University, and his research team published a comprehensive review article titled “*Revolutionary Near-Infrared Phosphors with Emerging Structures and Mechanisms Driving Next-Generation Applications*” in the prestigious journal *Progress in Materials Science*. Their review provides a systematic and in-depth examination of the evolution of near-infrared phosphor materials from the NIR-I to the NIR-III regions, offering detailed insights into structural design strategies, energy transfer mechanisms, and emerging application potential.

By integrating the theoretical frameworks of crystal structure, photophysical energy transfer mechanisms, and forward-looking application perspectives, the article presents a panoramic view of the current state and anticipated future directions of NIR phosphor research. The authors aim to set forth a solid foundation for the rational design of next-generation near-infrared luminescent materials.

Looking ahead, the team underscores that the incorporation of artificial intelligence and sustainable materials concepts will drive future research in two key directions: cross-scale integration and intelligent materials design. These advances are expected to open new vistas in high-efficiency lighting, biomedical imaging, and optical communication technologies.