# Researchers develop novel near-ultraviolet LED-excitable near-infrared emitters

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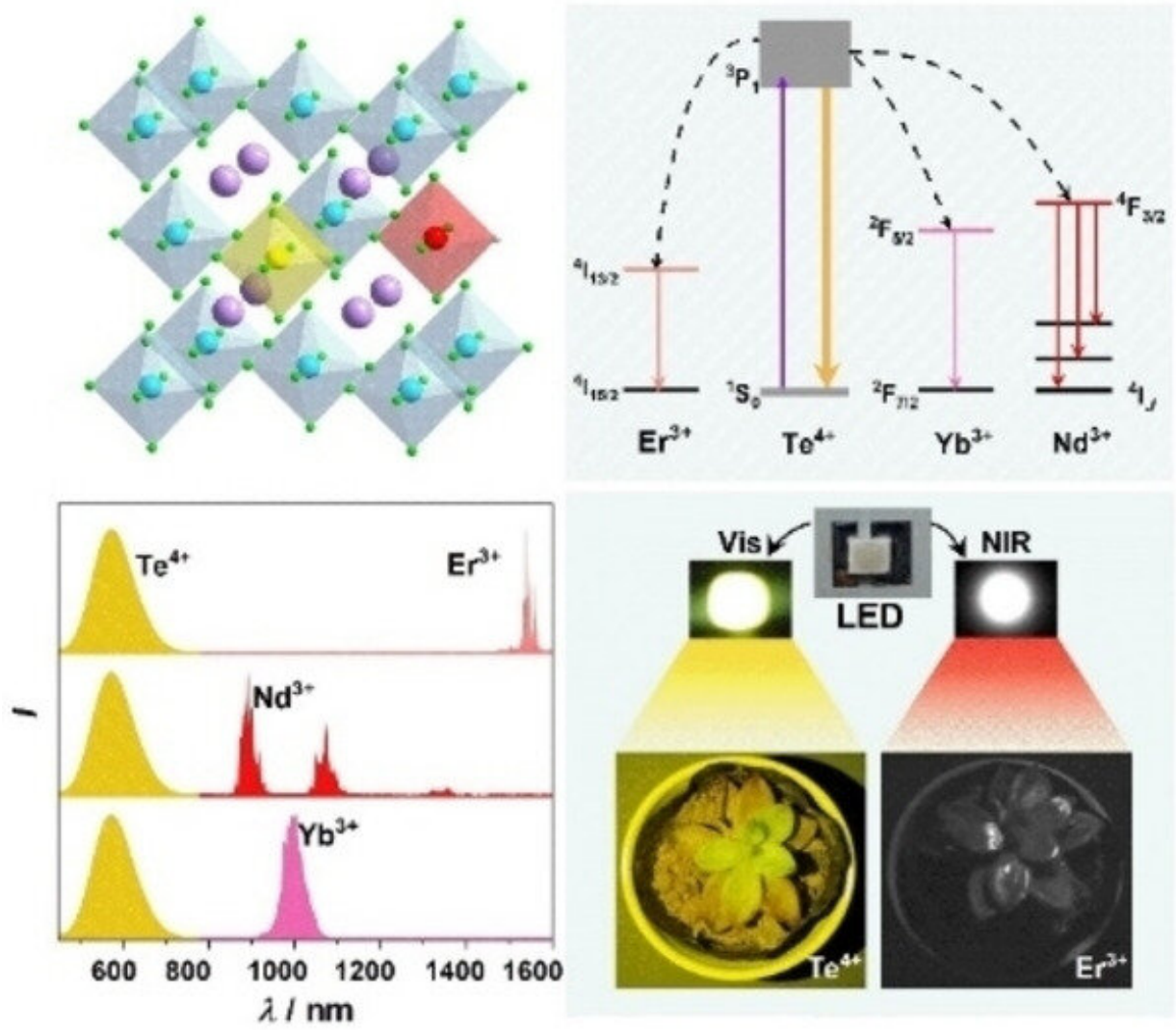


Schematic of efficient NIR luminescence in $Te^{4+}/Ln^{3+}$ co-doped $Cs_2ZrCl_6$ microcrystals. Credit: Prof. CHEN's group

All-inorganic, lead-free perovskite-derivative metal halides are promising in optoelectronics. However, it remains challenging to realize efficient near-infrared (NIR) luminescence in these materials.

A research group led by Prof. Chen Xueyuan from Fujian Institute of Research on the Structure of Matter of the Chinese Academy of Sciences (CAS) developed novel near-ultraviolet (NUV) light-emitting diode (LED)-excitable NIR emitters based on efficient energy transfer from $Te^{4+}$ to $Ln^{3+}$ (Ln = Er, Nd, and Yb) in vacancy-ordered double perovskite $Cs_2ZrCl_6$ phosphors.

The study was published in *Angewandte Chemie International Edition*.

Lanthanide ($Ln^{3+}$) doping may endow the materials with NIR emission, but is limited by the small absorption coefficient of $Ln^{3+}$ due to the parity-forbidden transitions within the $4f^N$ configurations.

The researchers proposed a strategy via $Te^{4+}/Ln^{3+}$ (Ln=Er, Nd, and Yb) co-doping to achieve efficient NIR emission in perovskite-derivative $Cs_2ZrCl_6$ microcrystals (MCs).

Through sensitization by the spin-orbital allowed $^1S_0 \rightarrow {}^3P_1$ transition of $Te^{4+}$, the researchers achieved intense and multi-wavelength NIR luminescence originating from the 4f → 4f transitions of $Er^{3+}$, $Nd^{3+}$, and $Yb^{3+}$.

Besides, the researchers demonstrated the excellent air-, structure-, and photo-stability of these $Te^{4+}/Ln^{3+}$ co-doped $Cs_2ZrCl_6$ and revealed their potentials as vis/NIR dual-emitters for applications in NUV-converted NIR-LEDs.

These findings provide an approach to achieve efficient NIR emission in lead-free metal halides through $ns^2$-metal and lanthanide ion co-doping.

**More information:** Jinyue Sun et al, Efficient Near-Infrared Luminescence in Lanthanide-Doped Vacancy-Ordered Double Perovskite $Cs_2ZrCl_6$ Phosphors via $Te^{4+}$ Sensitization, *Angewandte Chemie International Edition* (2022). DOI: 10.1002/anie.202201993