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

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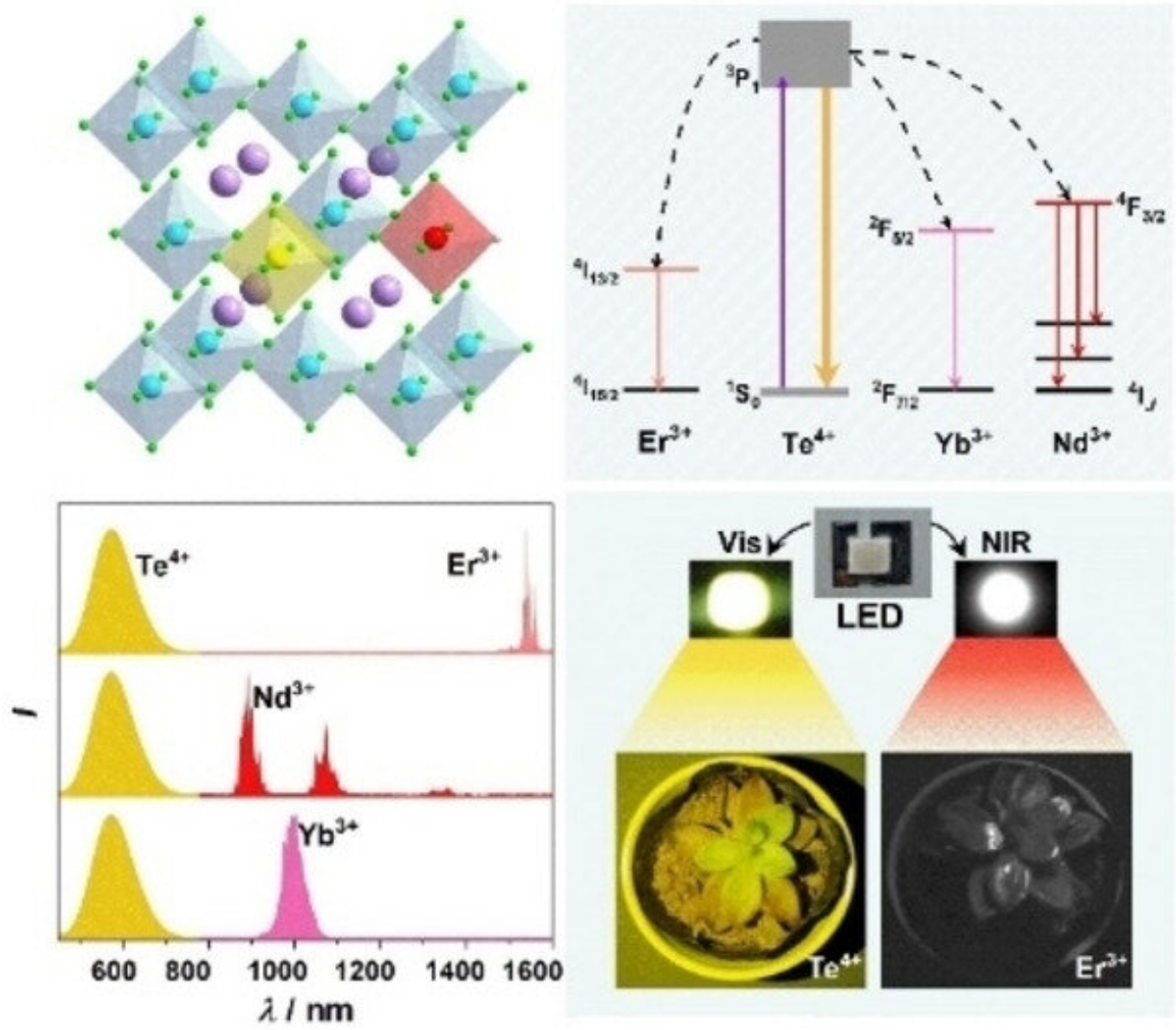

Schematic of efficient NIR luminescence in Te^{4+}/Ln^{3+} co-doped Cs_2ZrCl_6 microcrystals. Credit: Prof. CHEN's group

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

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