Rare earth luminescence and optoelectronic devices

Jilin University, China

Donglei Zhou
Email: zhoudl@jlu.edu.cn

The luminescence of trivalent rare earth ions is primarily based on the $4f^n$-$4f^n$ transition, or energy transfer between rare earth ions. This electronic transition is prohibited by parity, and emission can only occur when rare earth ions occupy the lattice position of the non-inversion symmetry center. When dealing with novel photoelectric applications, the following issues continue to exist: (1) The absorbance capacity is low. (2) Low luminescence efficiency. (3) Rare earth near-infrared electroluminescence has low efficiency.

In view of the above fundamental challenges, the following study has been carried out in three aspects: design of efficient luminous system, photoelectric performance control, and electric pump LED device.

Create novel rare earth quantum cutting luminescence to overcome the research bottleneck of rare earth absorption capacity and spectral conversion. A quantum clipping luminescence system with high efficiency energy transmission from a halide semiconductor to a rare earth ion was developed. The internal quantum efficiency was 173%, and the absorption cross section increased by 4-5 orders of magnitude. An effective quantum cutting light-conversion film for photovoltaics was created, increasing the efficiency of crystalline silicon cells by three percentage points. The work was highlighted in the journal Science and described as "This is one of the most exciting results I've seen in a long time."

Short Bio:

Donglei Zhou received his PhD degree in Microelectronics and Solid-State Electronics from Jilin University, China. He is a professor of Jilin University, China. Her research interests include rare earth luminescence and optoelectronic devices, with an emphasis on important issues in rare earth luminescent materials and devices, as reported in Adv. Mater., Light Sci. Appl., ACS Nano, Nano Lett., ACS Energy Lett., Adv. Energy Mater., and Adv. Funct. Mater. Other international journals produced more than 90 SCI retrieval papers, 34 h factor, 4 ESI highly cited papers, a single paper with the highest citation 594

times, and over 4500 favorable citations and comments on related work.