Migration-based energy storage and luminescence

Does energy migration facilitate energy transport over a long distance?
Unlike energy transfer,energy migration is able to facilitate energy transport over a long distance(Fig. 1b) 20. The manipulation of energy migration among Yb sublattice can produce color-switchable emissions 20,21,22,23 and tunable lifetimes across a wide range 24,25.

Why is energy migration important?
Energy migration is an essential process in numerous systems,such as natural photosynthetic proteins,artificial polymers,and inorganic optical materials1,2,3.

Does energy migration occur simultaneously with energy transfer in a sensitizer-activator system?
We show that energy migration indeedoccurs simultaneously with energy transfer in a sensitizer-activator system and the competition between them can be quantified by proposing a characteristic ratio parameter. Moreover,this model is also able to realize the color-switchable photochromic upconversion by temporal control of up-transition processes.

Does topological arrangement enhance upconversion luminescence?
Here,we report an inorganic optical nanosystem composed of NaErF 4 and NaYbF 4,in which topological arrangement enhanced upconversion luminescence. Three architectures are designed for considerations pertaining to energy migration and energy transfer within nanoparticles: outside-in,inside-out,and local energy transfer.

Which structure produces maximum upconversion luminescence?
The outside-in architectureproduces the maximum upconversion luminescence,around 6-times brighter than that of the inside-out at the single-particle level. Monte Carlo simulation suggests a topology-dependent energy migration favoring the upconversion luminescence of outside-in structure.

Which energy transfer pathways were added in the simulation?
The energy transfer pathways from sensitizer (Yb 3+) to activator (Er 3+) in the interlayerwere added in the simulation,leading to high non-radiative and radiative recombination rates from Er 3+and a decline of upconverted emission from Tm 3+in the core region. The details are provided in the Supplementary Information.

For CPs and MOFs, the afterglow emissions are related to metal center luminescence, "antenna effect" luminescence derived from lanthanide and actinide ions, guest ...

Based on this new fundamental insight, we have successfully realized fine control of upconversion emission time behavior (either rise or decay process) by tuning the ...

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Thus, it is possible to achieve upconversion and down-shifting dual-mode luminescence tuning in NaGdF 4 -based core-shell nanoparticles with the help of Gd 3+ ...

Degradation of cluster luminescence is reversible and restores after the heat treatment, indicating the possibility to release trapped electrons and return the initial charge ...

As the photovoltaic (PV) industry continues to evolve, advancements in Migration-based energy storage and luminescence have become critical to optimizing the utilization of renewable ...

As a nonlinear anti-Stokes process, upconversion luminescence originated from energy migration between different intermediate energy states of lanthanide activator ions 15. Thus, ...

Upconversion luminescence represents a nonlinear optical process whereby high-energy photons are emitted through the conservation of energy from two or more low-energy ...

Upconversion is a process in which one photon is emitted upon absorption of several photons of lower energy. Potential applications include super resolution spectroscopy, high density data ...

Smart control of energy interactions plays a key role in manipulating upconversion dynamics and tuning emission colors for lanthanide-doped materials. However, quantifying the energy flux in ...

Based on traditional understanding, energy migration among sensitizers is always neglected in UC dynamics treatment. In that case, although UC emission involves complex interactions ...

Moreover, we illustrate the versatility of UCC storage across various material systems through thermally- and optically-stimulated luminescence.

Here we present a comprehensive overview of the latest developments in energy migration upconversion in lanthanide-sensitized nanoparticles for photon upconversion tuning, ...

The interaction between multiple Ln ions results in significant energy migration and storage in the Yb sensitizer network, which is often recharged with the energy of the Er ions when they emit ...

Migration-based energy storage and luminescence

By enabling a thermosensitive property into the intermediate 4 I 11/2 level of Er 3+ through an energy-migration-mediated surface interaction, the upconverted luminescence ...

Specific dopant(s)-host combinations can also give rise to additional functionalities such as energy and charge transfer processes or quenching of the luminescence. Provided that an ...

Tunable Energy-Transfer Process in Heterometallic MOF Materials Based on 2,6-Naphthalenedicarboxylate: Solid-State Lighting and Near-Infrared Luminescence ...

In addition, various activators were doped into the Yb-BTC MOFs and their upconversion luminescence and energy-transfer mechanisms were studied. These MOFs show excellent ...

Precise control of energy migration between sensitizer ions and activator ions in lanthanide-doped upconversion nanoparticles (UCNPs) nowadays has been extensively investigated to achieve ...

In this work, luminescence properties of silver clusters in a silica-based glass were analyzed by using steady-state and time-resolved spectroscopy. The obtained results suggest that ...

Lanthanide (Ln)-doped upconverting nanocrystals (LnNPs) exhibit suitable features as energy donors for Förster resonance energy transfer (FRET). The sensitivity of biosensors can be ...

Theoretical analyses based on DFT calculations and energy transfer mechanism have been conducted to demonstrate UC enhancement of Er3+ through Tm 3+ mediated. ...

The modification of up-conversion dynamics via energy migration within nanostructure can lead to temperature-dependent colormetric lanthanide up-conversion ...