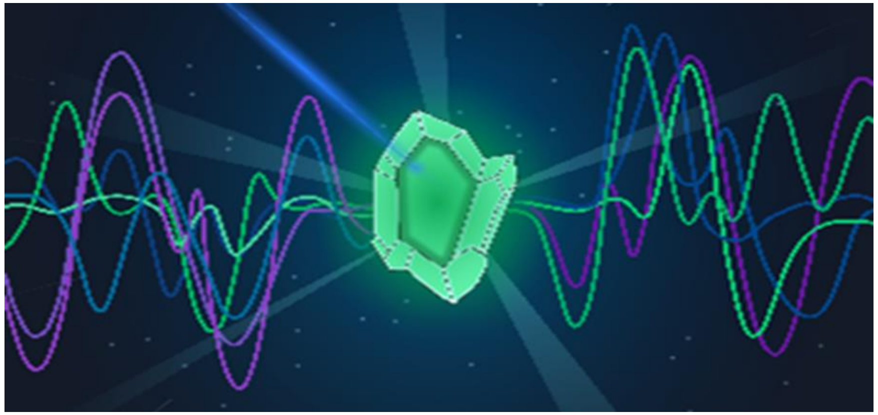
Technology Offer CSIC/MO/001

Analysis of persistent luminescence in the frequency domain: quantification of complex photophysical processes



Analysis method for materials with persistent luminescence that allows key parameters to be quantified directly, without fitting models in the time domain. Ideal for the development and optimization of emitting materials in applications such as bioimaging, signage, photocatalysis, and security.

Intellectual Property

Priority European patent application filed

Intended Collaboration

Licensing and/or co-development

Stage of development

TRL 4

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Market need

Conventional characterization of persistent luminescent materials is based on decay measurements in the time domain, which prevents the separation of processes with very different time scales. This limits our understanding of charge trapping and release mechanisms and forces us to optimize materials using empirical approaches focused on emission intensity, without access to fundamental physical parameters.

Proposed solution

An experimental method has been developed that applies frequency-modulated excitation to the material and analyzes the luminescent response using transfer functions. This system allows three frequency regimes (low, medium, and high) to be identified, associated respectively with charge release, interaction between processes, and trapping and decay of the excited state.

From these measurements, parameters such as trapping efficiency (β), trapping rate (p_1) and release rate (p_2), and thermal trapping barrier (E) are extracted. The method has been validated in $SrAl_2O_4:Eu^{2+},Dy^{3+}$ (SAO:Eu,Dy) crystals.

Competitive advantages

- Simultaneous separation of processes with very different time scales and high spectral sensitivity over an ultra-wide frequency range (1 mHz – 100 MHz).
- Application under continuous excitation, compatible with actual operating conditions.
- Versatility, applicable to multiple emitting materials, non-invasive, and compatible with standard optical techniques.