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27

Broadening the 1.53 µm emission bandwidth in Er3+-doped tellurite glasses from plasmonic structures

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The Er^{3+}: $^4I_{13/2} \rightarrow {}^4I_{15/2}$ emission band, centred at 1.53 μm, exhibits a wide bandwidth corresponding to the conventional optical communication window (C-band). (1) Several efforts were made to increase its bandwidth, e.g., co-doping with different rare-earth ions. (2) Nevertheless, this further complicates the dynamics of transitions between these rare-earth ions. Alternatively, the addition of metallic nanoparticles can be incorporated, but controlling the nanoparticle size and shape remains a significant challenge. (3) This research shows a bandwidth increment (about 70%) of the $^4I_{13/2} \rightarrow {}^4I_{15/2}$ emission band in Er^{3+}-doped tellurite glasses via surface plasmon- Er^{3+} coupling. Four nanostructures were fabricated, which consisted of an array of 8×8 square nanorods (width of 500 nm) varying their separation distance. Micro-luminescence spectroscopy was carried out to measure the reflection spectra under 980 nm excitation for the different nanostructures. The FWHM of the $^4I_{13/2} \rightarrow {}^4I_{15/2}$ emission band centred at 1536 nm calculated for the bulk glass is 60 nm, and the obtained with the nanostructures are 103 nm on average, covering the S, C and L communication bands. Such increment is ascribed to the population of the Stark levels of the $^4I_{13/2}$ and $^4I_{15/2}$ states due to the local field enhancement generated by the surface plasmon-Er^{3+} coupling. Further, varying the separation distance between the nanorods, the Stark levels' relative intensities vary, but the FWHM remains constant. Our system offers a straightforward approach to broadening the bandwidth and pioneering new directions in engineering Er^{3+} near-infrared emission performance at the nanoscale.

Palavras-chave: Plasmoncis; Tellurite glasses; Rare-earth ions.

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Referências:

1 KUMMARA, V. K. *et al.*. Near infrared broadband and visible upconversion emissions of erbium ions in oxyfluoride glasses for optical amplifier applications. **Optics and Laser Technology**, v. 127, p. 106167, 2020.

2 PINTO, I. C. *et al.*. Tailoring near-infrared luminescence with Er3+/Tm3+/Yb3+ tri-doped tellurite glasses for applications in the C, L and U bands. **Journal of Luminescence**, v. 265, p. 120206, 2024.

3 CALDERÓN, L. G. *et al.*. Quantum-plasmonic engineering to improve the 1.53 µm radiative emission in Er3+-doped tellurite glasses under controlled temperature. **Materials Research Bulletin**, v. 180, p. 113038-1-113038-10, 2024.