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Yb^{3+}-doped tellurite glasses: improved efficiency and low-threshold operation at 1080 nm

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Glasses doped with lanthanide ions display a wide range of applications, such as visible and infrared lasers, optical amplifiers and telecommunications, and sensing. In particular, Yb^{3+} exhibits a large absorption cross-section centred at 976 nm, with an intense and narrow emission at 1.0 µm. This Yb^{3+} emission is commonly employed in lasers and optical communications, e.g., Yb^{3+}: YAG lasers [1]. In this framework, the development of low-cost, efficient and easy-to-fabricate novel materials for laser active media is crucial. This research studies the emission performance of Yb^{3+}-tellurite glasses as an optical gain medium, demonstrating laser action at 1080 nm. Compared to common emissions at ≈ 1020 – 1030 nm [2,3], this atypical emission wavelength is explained by transitions between different Stark sublevels of the $^2F_{5/2}$ and $^2F_{7/2}$ energy states. Additionally, the measurements were carried out in a micro-luminescence spectrometer, allowing the precise control of the laser focus on the glass surface, ensuring a constant analyzing volume across all measurements for reliable sample comparison. Furthermore, the Yb^{3+} concentration was optimized, achieving a threshold at 120 mW for successful laser operation. Overall, this research provides valuable insights into the radiative properties of Yb^{3+}-doped tellurite glasses and their capacity to address current technological limitations in laser systems.

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