LASER ACTION AND UPCONVERSION OF Nd^{3+} IN TELLURITE BULK GLASS

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Recently, there has been a renewal of interest in solid state lasers, due to great advances in the development of semiconductor laser diodes, which can be used as pumping sources. Compact near-infrared lasers are demanded in fields such as optical communications, coherent laser radars, and medical instrumentation. Solid state lasers operating in the visible range are of interest for high-density optical storage devices, display techniques, optical spectroscopy, and optical communications. The intense pumping regime achieved with high power diode lasers generates non-linear effects such as upconversion in the laser media which may significantly affect the performance of rare-earth-based solid state lasers.

Among oxide glasses, tellurite ones have recently attracted interest because of their potentiality as hosts for lasing rare-earth ions since they provide a low phonon energy which noticeably reduces nonradiative losses by multiphonon relaxation. In addition, these glasses combine good mechanical stability, high linear and nonlinear refractive indices, with a wide transmission window (typically, 0.4-5 μm) which make them promising materials for technological applications such as new lasing materials, upconverting phosphors, and optical waveguides. .

In this work the laser emission together with upconversion processes which produce green, orange, and red emissions in Nd^{3+}-doped tellurite glass TeO_2-TiO_2-Nb_2O_5 are investigated for the first time. The upconversion processes were conducted in such a way that the dynamics of the visible fluorescence was analyzed under lasing and nonlasing conditions. The features observed in the time resolved upconverted emission show the existence of excited state absorption of both pump radiation and laser emission.