Nano-channel waveguides employed Er^{3+}-doped tellurite glass-dielectric with enhancement fluorescence

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The plasmonics forms a major part of the fascinating field of nanophotonics, which explores how electromagnetic fields can be confined over dimensions on the order of or smaller than the wavelength. It is based on interaction processes between electromagnetic radiation and conduction electrons at metallic interfaces or in small metallic nanostructures, leading to an enhanced optical near field of sub-wavelength dimension. On the other hand, the propagation of surface plasmon polaritons (SPPs) on metallic waveguides adjacent to a gain medium is considered. The absorption loss in metals, which causes damping of localized SPs and propagating SPPs, can be compensated for by the optical gain obtained with Erbium-doped tellurite glass (EDTG) adjacent to a metallic surface. The EDTGs are playing important role as optical amplifiers and lasers due to a variety potential applications. They have attracted much interest for optoelectronic and photonic applications because the emission in the telecommunication optical window is due to the $^4I_{13/2} \rightarrow ^4I_{15/2}$ transition, but also the upconversion transition. The intensities of transitions depend strongly on the nature and the structure of chemical environment around the rare-earth ion. In addition, Ag nanoparticles embedded in the host material results in a significant enhancement in their fluorescence due to long-range electromagnetic interaction between the plasmons on the Ag nanoparticles and the host medium. The enhanced local field and radiative decay rate will increase the fluorescence intensity, while the increased non-radiative decay rate, which results from the energy transfer from the host matrix (dielectric) to waveguide-metallic, will diminish the loss in the metal channel.

Keywords: plasmonic, tellurite glass, nano-waveguides, enhancement fluorescence.

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