TIME DOMAIN ANALYSIS OF LANTHANIDE ION DOPED CHALCOGENIDE GLASS FIBERS

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The time domain analysis of lanthanide ion doped chalcogenide glass fibers provides insight into their operation when applied as sources of mid-infrared radiation. The combination of both experimental and numerical techniques allows for the identification of relevant electronic transitions that are active under particular pumping wavelengths arrangements and also for an extraction of the material constants, which are key to the material characterization. The analysis of fiber samples rather than bulk glass samples when estimating material parameters is important because the additional processing steps carried out during fiber fabrication may influence the material structure.

The main experimental time domain technique consists in the measurement of the photoluminescence lifetimes for a particular value of the wavelength [1,2]. The numerical techniques attempt to reproduce the observed experimental behavior and thus assist the process of the interpretation of the experimentally observed results. The modelling parameters used for numerical models are derived from experimentally obtained data. The numerical models are based on the rate equations' approach to simulate the distribution of ions between the relevant energy levels [3]. The optical power distribution within the fiber is calculated by solving a set of either partial or ordinary differential equations using specially developed algorithms. The numerical results are compared with experimentally obtained data. The comparison between experimental and numerical results helps identification of the electronic transitions, which contribute to the observed photoluminescence. The particular lanthanide ions that are considered include terbium and praseodymium.

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