Fluorescence bandwidth of 280nm from broadband Ce^{3+}–doped silica fiber pumped with blue laser diode

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***Abstract*—Fluorescence properties of a Ce^{3+}-doped silica fiber at different pump wavelengths between 405nm to 450 nm are investigated. With 405 nm pump wavelength and a fiber length of ~130-140 cm broadband fluorescence of ~280nm is achieved.**

Keywords—Ce-doped fiber; broadband source; Ce^{3+} ions, fluorescence.

I. Introduction

Ce^{3+}-doped crystals and fibers are of great interest for their broadband fluorescent emission across the visible and near IR wavelength range [1]. Furthermore, Ce^{3+}-doped silica fibers are of particular interest for non-invasive biomedical techniques such as OCT [2]. Given the broad fluorescence spectrum from such fibers, they can serve as a good candidate for lighting applications [3]. In this publication, we characterize the fluorescence properties of a Ce^{3+}-doped silica fiber with pump wavelengths in the range of 405 nm to 450 nm. Ce^{3+}-doped silica fiber demonstrates fluorescence in the range of ~500 nm to ~820 nm with a spectral width of ~280 nm at -10 dB.

II. Experiment and Results

The Ce-Er-Al-silica core/pure silica cladding fiber is drawn from the preform fabricated by standard MCVD technology. To characterize the fluorescence properties of the Ce-doped fiber we utilize different pump lasers (405nm to 450nm) and a "Labsphere" CDS-600 spectrometer. The pump laser output is coupled into the Ce^{3+}-doped silica fiber using aspheric lenses. The output end of the Ce^{3+}-doped fiber is butt-coupled to the multimode SMA fiber (QP600-1-VIS-NIR) to record spectrum and output optical power. Initially, different pump wavelengths with 20 mW of output power were used with a 20 cm long Ce^{3+}-doped fiber to determine the optimal pump wavelength with the highest pump absorption. Once 405 nm is established as the optimal pump wavelength, fluorescence spectra of the different lengths of the fiber starting at 2 m are recorded at different pump powers in the range of 30 mW to 125 mW. The fiber length is reduced in steps of ~10 cm down to 30 cm.

It is observed that the pump is absorbed fully for fiber lengths longer than 60 cm. The spectral bandwidth at -10 dB remains within the range of 235 to 280 nm for all fiber lengths (30 cm to 2 m). The maximum -10 dB-bandwidth of ~280 nm (see Fig. 1) is observed for fiber lengths of ~130 cm and ~140 cm at pump powers of ~65 mW and ~100 mW respectively. To the best of our knowledge, this is the widest spectral bandwidth demonstrated from such fibers.

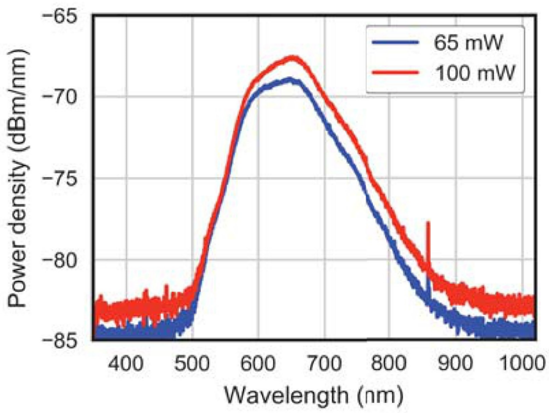

Fig. 1. Spectral bandwidth of ~ 280nm at different pump powers and fiber lengths (blue: ~130 cm and red ~140 cm)

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