Poster

NANOSCALE INDEX MODULATION IN PHOTOSENSITIVE DEVICES

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The development of photonic components of nanometric dimensions has received considerable attention lately. This effort was correlated with the growing interest for the development of photonic components operating at short wavelengths (visible and UV). The emergence of a fiber Bragg grating for these wavelenghts is of prime importance for the evolution of the related technologies and applications. In this paper we show experimental results of the inscription of a Bragg gratings in the visible as well as in the UV based on an improvement of the phase mask technique.

The most effective production method for high quality fiber Bragg gratings is to use a holographic diffraction grating. Figure 1 shows the basic principles of inscription of the index modulation in a photosensitive device. The beam from an argon laser doubled in frequency (244 nm) goes through a diffractive element that enables the recombination of the beam and leads to the modulation of the refractive index in the core of a germanium doped – hydrogen activated fiber.

Simulations were produced using IFO GRATINGS[1], software currently used for the study of a given fiber on the basis of the coupled mode theory[2]. These simulations support the validity of the inscription of a Bragg grating in the visible spectrum range. Figure 2 presents a comparison between the numerical simulation and the experimental results. The theoretical result has been obtained with a grating period of 249.5 nm and a chirp of 0.8nm/cm in a fiber with a 535 nm cutoff and a refractive index of 1.448. At Figure 3 we show a slanted grating operating around 380 nm.

The main application forseen for these gratings is the developpement of a new range of tunable fiber lasers in the visible electromagnetic spectrum region and even in the UV range. These gratings will enable us to increase the efficiency and stability of these lasers that, for the moment, use bulk components.

The inscription technique could also be applied to plane waveguides, to volume gratings as well as to fiber Bragg gratings inscribed in nanostructured fibers like holey fibers. Future objectives are to refine the inscription technique to increase the spectral selectivity. Furthermore, potential visible Bragg gratings market will promote the development of new nanotechnology components like optical couplers, optical circulators and visible broadband light source.

References:

[1] IFO_Gratings 4.0, Optiwave corporation 2000.
[2] T. Erdogan, "Fiber grating spectra," J. Lightwave Technol. 15, 1277-1294 (1997)
R. Kashyap, fiber Bragg gratings, Academic Press, New York, 1999

Figures:

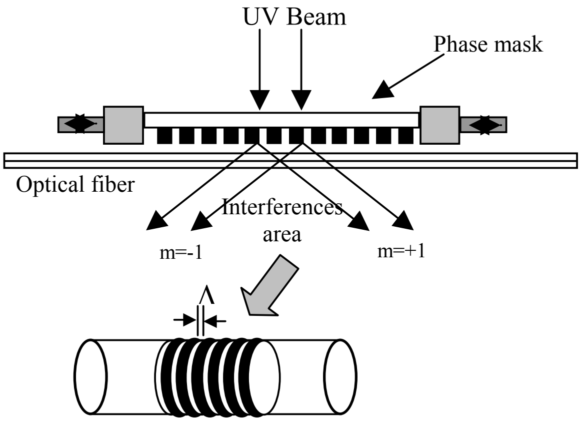

Figure 1 : Typical assembly for the inscription of the index modulation in a photosensitive device

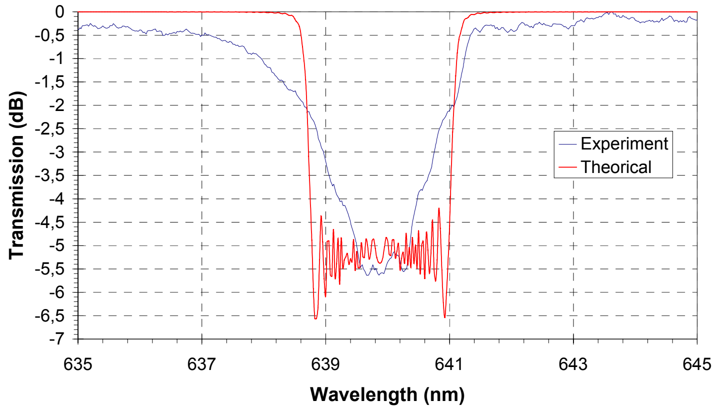

Figure 2 : Correlation between the simulation and the experimental results for a 640 nm chirp grating

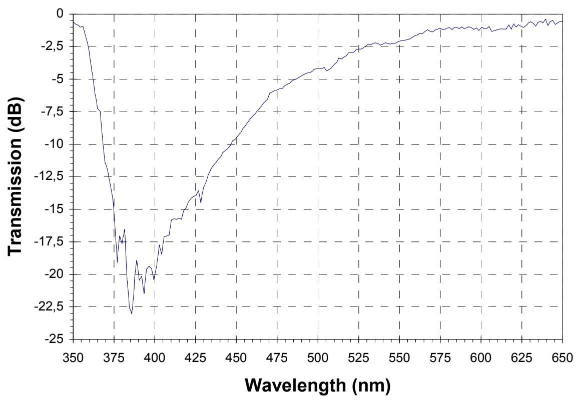

Figure 3 : Slanted grating around 380 nm showing cladding and radiative modes in a SMF-28 fiber