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DEPENDANCE OF AMBIENT REFRACTIVE INDEX SENSITIVITY WITH GRATING PERIOD OF LPFG

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ABSTRACT: *This study investigates the response of long period fiber grating (LPFG) to ambient index smaller than fiber cladding index at different grating periods. Here the basis of investigation is difference in resonant wavelength shifts of different ambient indices surrounding optical fiber cladding with periods. Mathematical approach using three layer geometry is implemented on standard fiber (SMF28e) to estimate cladding modes. The influence of grating periods (375 μm, 415 μm, 450 μm, 500 μm, and 550 μm) on LPFG index sensitivity is assessed for LP_{03}, LP_{04}, LP_{05}, and LP_{06} cladding modes. The largest shift of 127 nm for a range of ambient refractive index (1–1.455) is achieved by LP06 mode at a grating period of 550 μm.* © 2017 Wiley Periodicals, Inc. Microwave Opt Technol Lett 59:658–661, 2017; View this article online at wileyonlinelibrary.com. DOI 10.1002/mop.30366

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1. INTRODUCTION

The growing demand of long period fiber grating (LPFG) refractive index (RI) sensors in many fields like: environmental adulteration measurement [1], chemical, food and mining industries [2–4] have made theoretical analysis for designing these sensors more vital. LPFG has more control over the mode characteristics and propagating wavelength of light in an optical fiber that makes it much useful as an RI sensor. In a single-mode fiber (SMF), LPFG provides ability to couple light power in core mode to co-propagating cladding mode at particular resonant wavelength [4]. The mode coupling by LPFG generally depends on core-cladding indices difference, physical dimensions of core and cladding, and the grating period in the range from 100 μm to 1000 μm [5]. Due to mode coupling, attenuation dips at resonant wavelengths are observed in the spectral characteristics of LPFG. The spectral characteristics of cladding modes respond to variation in the ambient medium refractive index (ARI). The