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Optical parametric generation in photonic crystal fibers

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Light sources operating in the non-conventional wavelength band in which traditional lasers cannot oscillate have attracted great attention recently, since the applications of lasers are extending increasingly into new fields, such as biomedical imaging, spectroscopy and so on. Optical parametric generation in optical fibers refers to a phenomenon where weak spontaneous emission is amplified by the pump wave based on the effect of degenerate four-wave mixing (FWM). It can provide tunable radiation in non-conventional wavelength bands with the advantages of flexibility, low cost and compactness. The gain from parametric process depends on the phase matching condition among the pump, signal and idlers. And the dispersion profile of the gain fiber play a critical role in the phase matching mechanism. Photonic crystal fibers (PCFs) can provide more freedoms to customize its dispersion and nonlinearity, compared with the traditional fibers with doping technology. Especially its zero dispersion wavelengths can be located in nearly any wavelength and it has very large nonlinear coefficient. Thus, the parametric process in PCFs can provide gain in nearly any wavelength band according to the pump wavelength and the dispersion of PCF. Firstly, parametric wavelength conversion with very large span between visible and infrared band is demonstrated based on our homemade PCFs with two zero dispersion wavelengths. The theoretical design guideline is also introduced. Secondly, optical parametric amplifiers and oscillators based on PCFs pumped with 1060 nm band laser pulse are introduced in details. These works show that the optical parametric generation in PCFs is promising to provide light radiation in non-conventional wavelength bands.

Biography

Sigang Yang has received his PhD degree from the Department of Electronics Engineering, Tsinghua University in 2008. He was a Post-doctoral Fellow in the Department of Electrical and Electronic Engineering in the University of Hong Kong. He has joined the faculty of Tsinghua University in August of 2010. He is now an Associate Professor in the Department of Electronic Engineering, Tsinghua University. His research fields include computational electromagnetism, photonic crystal fibers; fiber nonlinearities; fiber based optical parametric amplifications (FOPAs) and oscillators (FOPOs); terahertz wave and frequency comb.

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