

Abstract

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Plasmonic Enhancement to Second-Order Nonlinearity in Optical Fibers: a comprehensive study

Several models have been employed for secondharmonic generation (SHG) in optical fibers. Their common drawback is the lowconversion efficiency of SHG. When cladding modes had been studied as pump signals through tilted fiber grating coated by nonlinear layers, an efficiency of the order 0.14% was reached. In this paper, a detailed investigation is carried out to study SHG in absorbing optical fibers, where a new schematic is proposed by adding a thin metallic film between the fiber cladding and the nonlinear layer to excite some plasmonic modes. These modes possess enhanced field amplitudes within the nonlinear layer, leading to a higher SHG efficiency up to 22% and 4% in case of using silver and gold, respectively. Solutions of the dispersion relation, intermodal phase matching, coupling between core and cladding modes, and field distributions are fully studied. The grating parameters are optimized to reach the maximum possible efficiency.