Nonlinear optical model for strip plasmonic waveguides

This paper presents a theoretical model of nonlinear optical properties for strip plasmonic waveguides. The particular waveguides geometry that we investigate contains a gold core, adhesion layers, and silicon dioxide cladding. It is shown that the third-order susceptibility of the gold core significantly depends on the layer thickness and has the dominant contribution to the effective third-order susceptibility of the long-range plasmon polariton mode. This results in two nonlinear optical effects in plasmonic waveguides, which we experimentally observed and reported in [Opt. Lett. 41, 317 (2016)]. The first effect is the nonlinear power saturation of the plasmonic mode, and the second effect is the spectral broadening of the plasmonic mode. Both nonlinear plasmonic effects can be used for practical applications and their appropriate model will be important for further developments in communication approaches. (C) 2016 Optical Society of America