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Plasmon Polariton Modes in High Index Dielectric Structures
KODIAK MURPHY, KYLE HOKE, BRAD JOHNSON, JANELLE LEGER, Western Washington Univ — The need to interface optical signals with high density electronic devices has led to an interest in subwavelength waveguides. Surface plasmon polaritons (SPPs) are surface charge density oscillations localized to a metal/dielectric interface, and as such are capable of confining energy in a structure which is not diffraction limited. Waveguides based on the excitation of SPPs are promising for short-range application, but in these structures Ohmic damping limits propagation length due to the bulk of the electric field propagating along a metal interface. Here we show that by selecting a core dielectric with a higher refractive index than the substrate, high index dielectric plasmon polariton modes (HID-PPMs) can be supported. Modes in the core dielectric exhibit electric fields with the bulk of their electric field confined in the dielectric layer. Therefore, damping may be reduced in such structures. Here we report the demonstration of HID-PPMs in Au/TiO2/Au MIM devices using attenuated total reflectance. Characterization of these modes was performed for devices of differing core dielectric thickness. Results are in good agreement with theory. We will discuss the application of these waveguides to several technologies related to solar energy conversion.

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