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Properties of guided modes in plasmonic aluminum quinoline waveguides NIRANJALA WICKREMASINGHE, JONATHAN THOMPSON, XIAOSHENG WANG, Department of Physics, University of Cincinnati, HEIDRUN SCHMITZER, Department of Physics, Xavier University, Cincinnati, HANS PETER WAGNER, Department of Physics, University of Cincinnati — We investigate the mode properties of aluminum-quinoline (Alq_3) waveguides with embedded thin (approximately 10 nm thick) $Mg_{0.9}Ag_{0.1}$ metal layers at a wavelength of 633 nm using the m-line technique. The plasmonic waveguides were fabricated on a Pyrex substrate by organic molecular beam deposition. Our experiments show that TM_0 modes in an Alq_3 waveguides with a single centered metal layer and TM_0, TM_1 and TM_2 modes in a waveguide with three metal layers have higher effective refractive indices as compared to a pure Alq_3 reference waveguide. These modes are attributed to plasmon-like modes in agreement with model calculations considering a complex dielectric constant for the metal layer. TM modes which possess a node at the location of the metal layer essentially behave like dielectric modes. TE modes are more affected by the embedded metal layer(s). The number of TE modes is reduced and the mode coupling angles are significantly shifted. Only one TE mode is observed in the waveguide containing three metal layers which is in agreement with model calculations. The results show that strategically placed metal layers can be used to selectively excite plasmonic and dielectric TM modes and to shift and suppress TE modes.

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