MASTER'S THESIS

Characteristics of plasmonic waveguide coupling and propagation

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Characteristics of Plasmonic Waveguide Coupling and Propagation

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Abstract

Surface plasmon polariton (SPP) offers the potential to produce novel devices for integrated optical circuit with promising characteristics of nano size chip dimension and faster operation speed comparing with traditional photonics and electrics devices.

The study and generation of SPP can be achieved via silver gratings. In this thesis, the design and parameters of the device, such as the grating period, the layers of the device are studied and optimized through theoretical calculations and simulations. We then fabricate the devices using electron beam lithography, and used for optical characterization methods, such as reflection, transmission spectroscopy and ellipsometry to study their optical properties. The experimental results are compared with theoretical predictions.

In addition, the propagation properties are investigated by a simple plasmonic device which contains silver gratings to achieve SPP incoupling, propagation and outcoupling. The propagation of SPP in dielectric medium has important application such as the dielectric loaded surface plasmon waveguide. Therefore, we studied the combination of grating coupled SPP and waveguide. The guided mode inside the dielectric layer which is sandwiched between metal and air can be selected by tuning the grating period. The guided modes are calculated by effective refractive index method. The fluorescent dye can act as the indicator of SPP propagating in the waveguide layer.

Finally, we propose a novel surface plasmon resonance sensor by combining the SPP components that have been studied. In future work, the performance of the device will be demonstrated and enhanced by experiments.

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