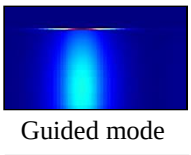
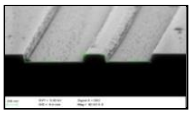
Ultra-compact Photonic Device for High Data-rate Optical Communication

High-speed broadband-communication has been playing a key role in present information era. Optical-fiber-communication provides high-speed and enormous-bandwidth. We are able to design and fabricate an ultra-compact photonic-device with low-loss, nano-scale optical-confinement, wide-bandwidth and low-dispersion.

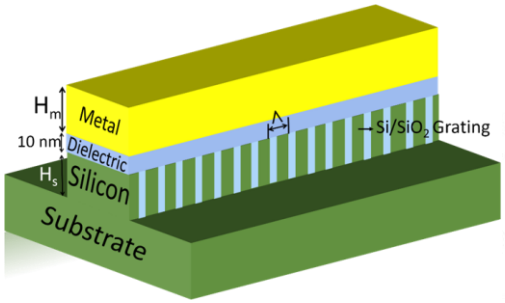
Our novel-approach of guiding and controlling the light at real nano-scale together with fabrication process developed for such devices makes our device ideal for high-speed broadband communication. The coupling of light with collective-oscillations of free-electrons at a metal-dielectric-interface is a potential candidate for nano-scale optical confinement beyond the diffraction-limit. We have utilized a high-index semiconductor-layer to offer a leaky-mode-confinement underneath the confinement-layer for the further reduction in the losses and for the tight-control in propagation-characteristics. The proposed hybrid-plasmonic-device has dielectric-layer sandwiched between high-index-silicon-layer and gold. The dielectric-layer is thermally-grown 11-nm thick SiO_2 on a silicon-substrate which gives a defect-free interface. The electron-beam lithography is used followed by reactive-ion-etching to achieve the desired-width of 300-nm of a proposed three-layer structure.



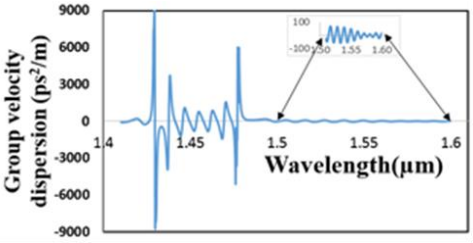
Guided mode



Fabricated array



Schematic of proposed device



Dispersion characteristics of the device showing ultra-low dispersion.

The proposed innovative design of the device is an excellent example of the combination of novel device-physics and semiconductor-technology. The proposed-mechanism and the adopted fabrication-process may open up new class of devices for high-speed and high data-rate broadband communication.

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