Abstract

Optical intensity modulators are an important element for integrated optoelectronics. Surface Plasmon-Polaritons (SPPs) are attractive candidates for this use due to their potential to produce high-speed compact devices. SPPs are surface electromagnetic waves that are trapped at the metal-dielectric interface due to their interaction with valence electrons of the conductor. Recent demonstrations of light guiding on closely spaced metal nano-particles have created interest for nano-photonic devices that will merge photonic and electronic functionalities at nano-scale dimensions. Optical modulators by means of SPPs have been demonstrated by modifying the refractive index of the dielectric medium. However, the fact that electro-optic effects tend to be weak in semiconductors while large electro-optic effects are obtainable only in slower materials, such as liquid crystals, hinders the modulation speed of such proposed devices. Previous approaches for producing surface plasmon optical modulation all possess various limitations. Therefore, there is a need for a surface plasmon optical modulation design at the nanometer scale that can be fabricated on semiconductor devices using fabrication techniques and equipment readily available in today's nano-fabrication facilities.

Boise State University has invented a device with rapid signaling and a smaller footprint. The present invention improves modulation efficiency (or increases modulation speed) of optical modulators, and does not require that the light wavelength correspond to the band edge of the semiconductor materials used nor does this invention require amplification of the surface plasmons of the MIS tunneling diode junction. Furthermore, this invention does not require wave-guiding to transport surface plasmons from an optical receiving structure to an optical sending. This device allows for very fast optical communication in a computer chip while reducing the space required. The basic concept is that light is shown on a metal-insulator barrier and based on the voltage applied across that barrier (and some other more complex phenomena) electrons either do or do not travel through the barrier resulting in a signal on the other side. The advantage of this process is that the signal can be turned on and off much faster and in a smaller space than is currently possible with other techniques. It allows for high bandwidth (perhaps over 20 Gbps) communication between microprocessors and chipsets in a small area.

Advantages

- Increases speed of communication between microprocessors/microchips, allowing for faster computing.
- Reduces the area required to communicate, reducing the size of chipsets.
- Allows for very fast optical communication which increases data transfer bandwidths in chipsets.
- Smaller than current technologies so it can fit in tighter spaces reducing the footprint size.

Boise State is looking for a Licensee for this technology.

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