Plasmonic modulator based on gain-assisted metal-semiconductor-metal waveguide - DTU Orbit (18/12/2018)

**Plasmonic modulator based on gain-assisted metal-semiconductor-metal waveguide**

We investigate plasmonic modulators with a gain material to be implemented as ultra-compact and ultra-fast active nanodevices in photonic integrated circuits. We analyze metal-semiconductor-metal (MSM) waveguides with InGaAsP-based active material layers as ultra-compact plasmonic modulators. The modulation is achieved by changing the gain of the core that results in different transmittance through the waveguides. A MSM waveguide enables high field localization and therefore high modulation speed. Bulk semiconductor, quantum wells and quantum dots, arranged in either horizontal or vertical layout, are considered as the core of the MSM waveguide. Dependences on the waveguide core size and gain values of various active materials are studied. The designs consider also practical aspects like n- and p-doped layers and barriers in order to obtain results as close to reality. The effective propagation constants in the MSM waveguides are calculated numerically. Their changes in the switching process are considered as a figure of merit. We show that a MSM waveguide with electrical current control of the gain incorporates compactness and deep modulation along with a reasonable level of transmittance.

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