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Surface plasmon polaritons (SPPs) are waves propagating at the interface between a metal and a dielectric and, due to their tight confinement, may be used for nanoscale control of the light propagation. Thus, photonic integrated circuits can benefit from devices using SPPs because of their highly compact and fast response time characteristics.

In this talk we will present plasmonic modulators with sandwich geometry where the sides are composed of thin metallic layers while the center is an active material with controlled gain coefficient (see figure). In particular, we analyse InGaAsP-based active core. Using such geometry we can obtain high modulation speed, low footprint and high modulation depth. We discuss the dependence of the waveguide core size and gain for different thicknesses of the metallic layers. Due to the finite and small thickness of these layers, several coupled modes can be obtained. We chose only one of these modes to study since calculations showed it is the one allowing for the highest modulation depth while the gain levels needed in order to obtain loss compensation are still within practical reach.

Various possibilities for defining the field confinement are discussed as well as relative effective index, absorption coefficient and extinction ratio of the modulator. The differences between the 2D and 3D cases are also succinctly described.