Surface Plasmons Polaritons Going Practical

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Surface Plasmons Polaritons (SPP) are transverse magnetic (TM) polarized electromagnetic waves propagating under specific conditions along a metal-dielectric interface. Plasmon devices enable to carry optical signals and electric currents through the same thin metal circuitry, thereby opening the perspective of inserting electrically driven devices on the same circuitry on which light is propagating. Exploring the potential of an hybrid technology merging plasmon and silicon photonics on a single board, this contribution describes the efforts of the European FP7 projects PLATON & PHOXTROT towards the practical implementation and testing in true optical data processing conditions of plasmonic devices in optical interconnects implemented at various levels : optochip, optoboard and chip-to-board interfaces.

FP7 PLATON showed that low-loss figures can be achieved by an hybrid SOI/plasmonic design reducing plasmonic function to short active lengths of optical circuits. It also showed that the plasmonic switches readily achieve a better figure of merit than alternative technologies pertinent in this context. FP7 project PHOXTROT is currently considering the use of plasmonic devices to manage several critical issues of chip-to-board optical links. Both projects showed that there is much room for signifi cant improvements if the CMOS compatibility of plasmonic devices is consistently addressed. CMOS compatibility basically means to avoid the use of gold or silver which are routinely used in basic plasmonic research. This issue is currently addressed within H2020 project PLASMOFAB on the basis of three scenarios: polycrystalline aluminum, crystalline aluminum and Titanium Nitride (TiN) in the three plasmonic waveguide configurations allowing most short-term application perspectives in optical interconnect technology: LRSPP, slot or DLSPP waveguides. For each family, coupling interface solution featuring acceptable losses can be designed. We will conclude by sketching the impact of these CMOS compactible materials on plamonic devices relevant in the optical interconnect context such as high speed MZI modulators, switches and power monitors.