Wavelength Selective Nanophotonic Components Utilizing Channel Plasmon Polaritons

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Channel plasmon polaritons (CPPs) are electromagnetic waves that are bound to and propagate along the bottom of grooves cut into a metal.[1] They are expected to exhibit useful subwavelength confinement, relatively low propagation loss, and single mode operation[1, 2] as well as efficient transmission around sharp bends.[3] Our previous experiments showed that the CPPs at telecom wavelengths propagate over tens of micrometers along grooves in gold and exhibit strong subwavelength confinement[4] along with low bend losses in large-angle S-bends and Y-splitters,[5] thereby enabling the realization of ultracompact plasmonic components, such as Mach-Zehnder interferometers and waveguide-ring (WR) resonators.[6] The results obtained with the above set of structures encouraged us to further exploit the potential of CPPs and to investigate more sophisticated and/or new functional plasmonic components. Here, we report the fabrication and investigation of CPP-based wavelength selective components operating at telecom wavelengths: a WR resonator-based add-drop multiplexer (WRR-ADM) composed of two 0.5-μm-wide and 1.3-μm-deep gold grooves combined with a 5-μm-radius ring resonator and a compact (3.75-μm-long) Bragg grating filter (BGF) comprised 0.5-μm-long wells milled with the period of 0.75 μm across a groove. High quality SNOM images of the components have been obtained in the wavelength range of 1425-1600 nm and analyzed to determine their characteristics.

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