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Integration of metal nano-particles in organic waveguides

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Photonics Research is evolving towards the development of novel functional materials to perform more complex and efficient tasks. In this way the incorporation of metal nanoparticles (MNP) in photonic devices is an interesting approach. These nanostructures present interesting properties like a localized surface plasmon polariton (LR-SPP) or high scattering cross section, which can provide new performances in fields like sensing or solar cells. For this purpose an elegant solution to integrate the MNP in photonic devices is their incorporation into a host matrix to form a nano-composite, because this synthetic multi-component material combines the properties of the nanoparticles with the technological feasibilities of the matrix. In this work the integration of MNP in organic waveguides is proposed by embedding Au MNP in epoxy novolac resist. This is a commercially available photoresist which enables patterning the nanocomposite by UV lithography. Furthermore, a method to grow the MNP inside the polymer is proposed in order to tune the plasmon resonance and the scattering of the metal nanostructures inside the patterns. Then, the nanocomposite is used as a cladding of a PMMA waveguide fabricated on a silicon platform in order to exploit the properties of the MNP in the different fields. By controlling carefully the size of the MNP it became possible to couple incident light into waveguide modes or to demonstrate sensing with the effect of the MNP in the wave guided light.

Biography

Mattia Signoretto is a Physics graduate (University of Trento, Italy, 2010) and completed Master's degree in Experimental Physics in the specialty of Photonics (University of Trento, Italy, 2012). He is currently pursuing his PhD degree in Material Science as a member of the UMDO unit of research at the Institute of Materials Science of the University of Valencia (ICMUV). His current work for PhD thesis focuses on the fabrication and characterization of nanocomposite and plasmonic waveguide and their applications in optoelectronic devices.

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