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Polariton Engineering with Quantum Materials

Ingrid D. Barcelos[1]

[1]*Brazilian Synchrotron Light Laboratory (LNLS), Brazilian Center for Research in Energy and Materials (CNPEM), 13083-970 Campinas, SP, Brazil*

ingrid.barcelos@lnls.br

Abstract

Polaritons, which are quasiparticles composed of a photon coupled to an electric or magnetic dipole, are a major focus in nanophotonic research of low-dimensional materials. Polaritons can be active in a broad range of the electromagnetic spectrum (meVs to eVs) and exhibit momenta much higher than the corresponding free-space radiation. Hence, the use of high momentum broadband sources or probes is imperative to excite those quasiparticles and measure the frequency-momentum dispersion relations, which provide insights into polariton dynamics. Synchrotron infrared nanospectroscopy[1] (SINS) is a technique that combines the nanoscale spatial resolution of scattering-type scanning near-field optical microscopy with synchrotron infrared radiation, making it highly suitable to probe and characterize a variety of polaritons. Here, the advances enabled by SINS on the study of key different types of polaritons from the THZ to mid-infrared will be described. In this talk, I will explore low-dimensional materials [2,3] as the polaritonic materials and their remarkable optical properties. I will present recent studies in the field of polaritons in contact with different interfaces dielectric/air(metal) and heterostructures using SINS. Furthermore, I will show that these experimental observations provide an attractive platform for understanding light-matter interaction and, therefore, could be harnessed in compact nanophotonic devices and applications involving subdiffractional light traffic.

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References

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