(Talk) Dielectric-Loaded Phonon Polaritons

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We report the first observation of highly confined polaritons with wavelength two orders of magnitude shorter than the free space wavelength that propagates on the surface of silicon carbide crystals covered by a few atomic layers of molybdenum disulfide. Confined surface polaritons attract increasing attention as a promising platform for nanoscale opto-electronic integrated circuits enabling strong light-mater interactions. Recently, a new approach for confining surface phonon-polaritons (SPhPs) in bulk polar crystals by ultrathin capping layer has been experimentally demonstrated in quartz/GST system. However, the ultimate performance of the device was limited by the film quality on few-nm thickness scale, and would also require a stronger polar crystal. In this work, we meet these requirements by placing nanometric layers of twodimensional dielectric materials on a bulk silicon carbide substrate. To experimentally excite SPhPs we use mid-IR radiation of CO_2-gas laser at frequencies between 930 and 897 cm^{-1}. Scattering-type scanning near-field optical microscopy revealed deeply subwavelength confinement of SPhPs in the MoS_2-SiC interface down to bi-layer of the layered dielectric. The confinement factor is highly sensitive to both the MoS_2 thickness and the spectral line of excitation. We experimentally perform a systematic study of thickness and spectral dependency of the confinement, and fit the data with theoretically calculated dispersion. Approach discussed in our work enables realization of ultimate light-matter interaction on the interface of nanometric layered dielectrics supported by bulk polar crystals down to the fundamental atomic limit, opening a new avenue on the surface polaritons confinement at nanoscale.