

Hybridisation of semiconductor surface plasmon polaritons and molecular excitations

ZnO can be heavily doped n-type providing free-electron concentrations up to 10^{21} cm^{-3} without essential degradation of the crystalline perfection. These electrons give rise to metallic optical properties in the infrared spectral range. In particular, low-loss surface plasmon polaritons (SPPs) can be generated. Unlike traditional metals, the surface plasma frequency can be tuned to a desired position from the mid to the near infrared region. ZnO-based SPPs are thus ideally suited for the coupling with infrared excitations in matter. In a proof-of-concept experiment, resonant coupling with molecular vibrations of C40 has been indeed observed. In the Phd project, these initial results shall be extended to the strong-coupling regime as well as to electronic excitations. The potential for optically transporting vibrational excitation or electronic charge on the nanoscale by these plasmon-molecule hybrid states will be also a subject.