GEMaC

Groupe d'Étude de la Matière Condensée

OPTICAL SPECTROSCOPY OF SEMICONDUCTORS

The team investigates the optical properties and in particular the light emission in II-VI semiconductors, diamond, halide perovskites and 2D materials. Our studies are based on Photoluminescence, Raman and Fourier Transform Infrared (FTIR) Spectroscopy. Among other subjects, we are interested in the defects and impurities properties in semiconductors (bulk, thin films, nanostructures), strain effect, quantum confinement, quantum-confined Stark effect in ZnO/ZnMgO ZnO heterostructures.

Spectroscopy of ZnO

The photoluminescence spectroscopy (PL) is a useful technique to identify dopants in zinc oxide. Two situations are possible depending on the type of doping. For doping with donor-type impurities, the PL spectra at low temperatures are dominated by recombinations of excitons bound to impurities. These bound excitons narrow lines most often come from the localization of the excitons on the column III impurities (aluminum, gallium, indium, etc.). In the case of doping with acceptors, elements of column IV (nitrogen, phosphorus, arsenic, antimony, etc.), the spectra are highly modified with a strong attenuation of the band edge excitonic lines and the appearance of donor-acceptor bands. (DAP), at lower energy. These properties have been observed both on thin layers and in single nanowires measured by micro-PL.

Planar or core-shell nanowires quantum nanostructures present original optical properties as a function of the symmetry of the crystallographic growth planes. Indeed, for polar surfaces, band structures are subjected to an internal electric field which shift the energy bands and leads to a confined Stark effect, resulting in a spatial separation of the charge carriers. Under these conditions the radiative yield is strongly affected, and is therefore not favorable for emission. On the other hand, for non-polar surfaces, for example the lateral facets of nanowires that grow along the C axis, the Stark effect is no longer effective.