

Title: Operando investigation of optoelectronic device using advanced photoemission

Keywords: X-ray photoemission, optoelectronic, device, operando, synchrotron

Scientific description: Beyond traditional semiconductor grown by epitaxy there is a broad zoology of emerging materials (quantum dot, 2D material, quantum and topologic material), However the integration of such materials requires a deep knowledge of their electronic structure. The basic hypothesis so far relies on measuring pristine material and hope that the property will be mostly unchanged once the material is integrated within a device. Such hypothesis is certainly sufficient for first generation of device but is clearly insufficient to push performances. Thus, new method enabling operando (within the device under operation) investigation are required. INSP team just build a new platform combining broadband capability (from few meV to 5 keV) by combining Raman, infrared, visible spectroscopy together with multi source X ray photoemission. Setup further enables control of temperature and bias application. With this unique platform we now aim to unveil properties that were far inaccessible. A paramount example is the investigation of nanocrystal-based LED. Such device has a vertical geometry that is incompatible with the low escape depth of photo electron. However, the hard X-ray capacity of our setup combined with update of device design using 2D material will enable to probe the active layer operando. Additional measurement conducted at synchrotron to gain more flux or spatial resolution will also be part of the project at PhD time scale

Techniques/methods in use: clean room, XPS in the lab and at synchrotron, optoelectronic device characterization

Applicant skills: a good background in semiconductor physic is necessary. The project is highly pluridisciplinar with chemistry, physics and engineering, thus additional background may include photoemission, 2D material, nanocrystals, device fabrication can be a plus. Applicants must speak English

Industrial partnership: No, at starting date, but the group is highly connected with industrial partners.

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Internship location: INSP tower 22

Possibility for a Doctoral thesis: Yes and actually applicant willing to do thesis are highly preferred. **FUNDING IS SECURED**