

Coupling on a confocal imaging system μ -Raman, μ -PL/TRPL, LBIC and AFM for nanoscale characterization

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With the emergence of nano-electronic devices, new materials, thin layers and nano structures are developed in order to increase photovoltaic absorbers efficiency, reduce device power consumption, enhance the frequency limit etc. To probe such materials, the characterization techniques are getting more and more demanding, accurate and precise. We present a platform (Figure,a) that combines different characterization techniques, to

probe locally: structural, optoelectronic, electrical and topographical properties of semiconductors materials. Different spectroscopy techniques: μ -Raman, μ -PL/TRPL, LBIC can be achieved at the same place, coupled with AFM / CP-AFM. In, this talk I will present the capabilities and the limits of the platform through case studies. With high magnification objectives and 3 axes piezoelectric stages, sample spectroscopy information can be represented in mappings. Raman scattering (Figure,b) informs on the chemical atomic bondings nature and constraint (tensile, compressive) but also rely on crystal quality. Polarised raman scattering gives additional information on the azimuthal dependence of the optical and acoustical vibrational modes, related to crystalline orientation. PL (Figure,c) spectroscopy informs on optoelectronic properties, by probing surface and inter layers quality and impurity level, while TRPL (TCSPC precisely) reveals carriers decay over time subsequent to a short pulse of light. LBIC technique (Figure,d) allows to measure the device current induced by light. Surface topography and roughness is achieved by AFM (Figure,e) while CP-AFM extension gives further information on the local electrical properties. By coupling those techniques we offer a powerful tool for the study of nanoscale materials and devices.

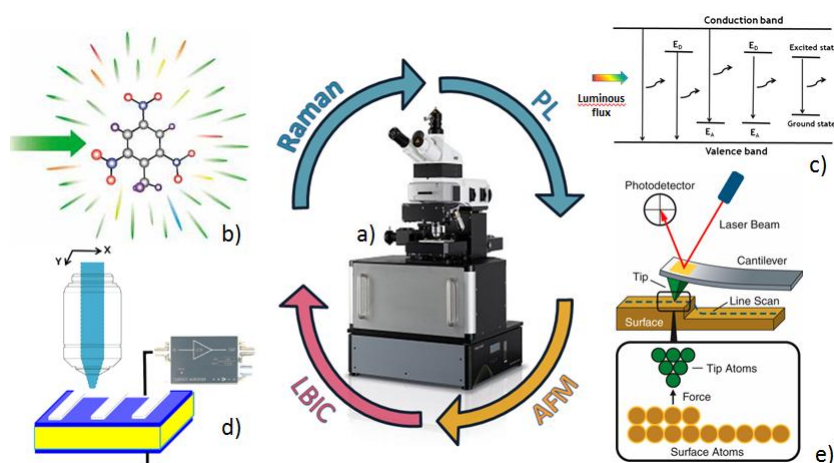


Figure: (a) Confocal microscope (b) Raman scattering scheme: Incident green light on a molecule, elastic diffusion (green) and inelastic diffusion (other colors) (c) PL band diagram: Band to band transition and defects (d) LBIC technique on solar cell (e) AFM contact mode principle