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PbS nanoparticles/single-wall Carbon Nanotubes nanohybrid materials synthesis by means of the pulsed laser deposition approach and their integration into photoactive devices**My Ali El Khakani**

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We will recall first the unique features of the Pulsed Laser Deposition (PLD) technique and its latitude to synthesize either 0D and 1D nanomaterials or Nanohybrid (NH) structures. Secondly, the PLD technique will be shown to be highly effective for the physical synthesis of highly crystalline PbS NanoParticles (NPs) onto various substrates with the latitude to tailor their size, and hence their bandgap over the 0.75-1.45 eV through quantum confinement effects. Finally, we will show that the PLD is very appropriate for the decoration of 1D nanomaterials (e.g., Single-Wall Carbon Nanotubes (SWCNTs) or TiO₂ nanorods (NRs)) by PbS-NPs leading to the formation of a novel class of nanohybrid materials. The achieved SWCNT/PbS-NPs nanohybrids were straightforwardly integrated into PhotoConductive (PC) devices exhibiting unprecedented photo-response values (~700 % and ~1400 % at 633 and 405 nm, respectively). On the other hand, the TiO₂-NRs/SWCNTs nanostructures were integrated into nano-heterojunction PV devices of which PCE was as high as 5.3%. The high-purity of the PbS NPs along with their intimate bonding to the 1D structures (without the use of any bridging ligands) are key factors to ensure a highly efficient charge transfer between PbS-NPs and SWCNTs. This particular architecture is believed to be responsible for the remarkable PC/PV properties of these PLD synthesized nanohybrid materials, where the occurrence of Multi-Exciton Generation (MEG) has been recently pointed out.

Biography

My Ali El Khakani is the Leader of the NanoMat Group which he founded at the Institut National de la Recherche Scientifique (Centre-Energie, Matériaux et Télécommunications, Canada). He has published more than 190 refereed publications in prestigious journals and co-holds 5 patents. He has served on the Editorial-Board of *Sensors Letters* and he is currently a Member of the Editorial Board of the *Nanotechnology* and *Scientific Reports* journals. He is also a regular reviewer for more than 25 refereed scientific journals.

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