Bruno Ullrich, J Nanomed Nanotechnol 2014, 5:5
http://dx.doi.org/10.4172/2157-7439.S1.017

OMICS Group Conferences
Accelerating Scientific Discovery

4th International Conference on
Nanotek & Expo

December 01-03, 2014 DoubleTree by Hilton Hotel San Francisco Airport, USA

GaAs band gap engineering by colloidal PbS quantum dots

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The hetero-pairing of colloidal quantum dots (QDs) with semiconducting hosts considerably enlarges the technological application bandwidth of this material platform, which suits mass-market production. The precise knowledge of the temperature influence on the optical properties of the QDs is of relevance, while the novel aspect here is the alteration of the host properties by the electronic influence of the deposited QDs. The presentation discusses the trend of the band gap (E_g) of PbS QDs vs. temperature (T). It was reported in countless articles that $E_g(T)$ of QDs varies - here we sort out the differences in the *nonlinear* $E_g(T)$ shapes of QDs on multiple substrates including GaAs due to PbS QD size variations (~2-5 nm), and we address the impact of PbS QDs on the electronic and optical properties of GaAs substrates. This section follows up our study of photoluminescence (PL) of PbS QDs on GaAs, demonstrating that the GaAs PL is enhanced by the presence of PbS QDs. In the current work we particularly analyze the slope changes of the GaAs absorption edge due to the deposition of PbS QDs. The findings give new insights in optical device engineering using charge transfer between bulk and quantized matter.

Biography

Bruno Ullrich has completed his PhD at the University of Vienna in 1988. After postdoctoral studies at the Universities in Strasbourg and Graz, he worked in Japan at the University of Tokyo and RIKEN Sendai. He held teaching and research positions at Bowling Green State University (BGSU) and the Air Force Research Laboratory (AFRL) at the Wright-Patterson Air Force Base (WPAFB). He is the director of the Optical Laboratory at the Instituto de Ciencias Fisicas (ICF) at the Universidad Nacional Autónoma de México (UNAM). He has published over 200 papers and holds several patents in the field.

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