Asesor: Dr. Elder de la Rosa Cruz

Sinodales: Dr. Luis Arturo Godínez Mora-Tovar
(Sinodal Externo – CIDETEQ, Secretario)

Dr. Ramón Carriles Jaimes
(Sinodal Interno, Vocal)

Dr. Elder de la Rosa Cruz
(Asesor de Tesis, Presidente)

Tesis: **"STUDY OF THE PHOTO-CONVERSION EFFICIENCY OF QUANTUM DOTS SENSITIZED TiO2 SOLAR CELLS WITH VISIBLE-INFRARED ABSORPTION"**

Resumen:

Quantum Dots (QDs) are currently being investigated for application into solar cells to enhance the cell efficiency based on the photovoltaic parameters such as photocurrent, photovoltage and fill factor. Our aim is to increase the photocurrent using different QDs, which absorption in the visible and infrared region. The most common QDs with absorption in the visible range are the Cadmium Sulphide (CdS) and Cadmium Selenide (CdSe) QDs. The effect of different sensitization techniques in the configuration TiO2/CdS/CdSe/ZnS is analyzed; with this configuration a photoconversion efficiency (PCE) of 4.7% is obtained. A strong absorption band centered at 650 nm reveals the contribution of colloidal CdSe QDs. The infrared region is studied with lead sulphide (PbS) QDs in the configuration TiO2/PbS/CdS/ZnS, where we find that the infrared absorption is for the PbS, several authors use the CdS for protected the oxidation of PbS. The TiO2/PbS/CdS/ZnS QDSSCs have been compared with the efficient electron transport of the TiO2/PbS/PFN/CdS/ZnS configuration, where PFN is poly[(9,9-bis(3'-(N,N-dimethylamino)propyl)-2,7-fluorene)-alt-2,7-(9,9–dioctylfluorene)]. The PbS was used in TiO2/PbS/PFN/CdS/ZnS configuration to obtain a 3.6 % photo conversion efficiency (PCE) by the utilization of a PFN active layer, which increases short circuit current by the light scattering strategy. Moreover, the less toxicity of Bismuth sulfide (Bi2S3) has been applied to TiO2/CdS/Bi2S3/ZnS configuration instead of PbS, we found a PCE of 2.52%. It is important to note that the enhancement in the cell efficiency was explained by broadening the absorption spectra and energy level diagram to reduce the transport losses because of superficial defects. One of the most efficient colloidal materials, Cadmium Selenide Telluride(CdSeTe) QDs, was added into the TiO2/CdS/CdSe/CdSeTe/ZnS/SiO2 configuration, resulting in a record PCE of 7.4%. The general increase of absorption as well as a shift towards longer wavelengths up to 800 nm was observed clearly with the coating of colloidal CdSeTe QDs. Finally a preliminary result about perovskite solar cells and perovskite QDs is presented.