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SEMINARIO DE ESTUDIANTES

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Institución:	IFUAP
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Resumen:

Incorporation of plasmonic nanoparticles (NPs) has been considered recently to increase the absorption efficiency and/or the photocurrent of dye sensitized solar cells (DSSCs). In DSSCs light absorption (by the dye molecules) and electron transport (in the TiO_2) processes do not take place in the same material, contrary to the single crystal solar cells. This offers the advantage of incorporating new materials in electrodes to improve their light absorption efficiencies. One of the most substantial improvement made in DSSCs in recent time is through the incorporation of plasmonic nanostructures, typically silver (Ag) or gold (Au) nanoparticles, through the enhancement of photo-absorption cross section of dye molecules and photo-charging effect [1]. Here, I will present results associated to the interaction of light with Au nanoparticles featuring light harvesting improvement and photocharging effect on the matrix of nanostructured semiconductor electrodes of dye sensitized solar cells (DSSCs). The work was performed by direct interaction of light with DSSCs electrodes fabricated with and without bare Au nanoparticles of about 27 nm average size. Small perturbation, and soft X-ray spectroscopies[2] have been utilized to determine the contribution of Au nanoparticles on the photo-charging (Fermi level shift) and band gap narrowing of the TiO_2 electrodes. Our results indicate that: (1) the incorporation of Au nanoparticles of about 27 nm diameter in the solar cell electrodes increases their open circuit voltage due to an upward shift of the TiO_2 conduction band (termed photo-charging effect), (2) the short circuit photocurrent increases due to an upward shift of the TiO_2 valence band edge, reducing its effective band gap energy and enhancing their light absorption.

References:

[1] ACS Nano 2012, 6, 4418-4427.

[2] 10.1021/acsami.8b10063