

Book of Abstracts

39th



Indian Engineering Congress

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Theme

Irresistible India -
a Global Engineering Powerhouse

Organised by



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Hosted by

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Power & Energy: Renewable Energy Technologies



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Quantum Dot Solar Cell: Device Modelling and Efficiency Enhancement using CdTe Quantum Dots

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Abstract: The electrical and optical properties of a novel Quantum Dot solar cell (QDSC) using CdTe quantum dots were explored and simulated using the Silvaco TCAD software (version: 5.26.1.R). A proposed structure of a device comprises the incorporating of cadmium telluride quantum dots in the active layer that consists of Gallium Arsenide (GaAs) supported by the nickel oxide (NiO) hole transport layer and by the zinc oxide electron transport layer. QDSCs can accommodate multiple excitation generation (MEG) which helps in multiple carrier generation for one photon absorbed, which gives them the edge compared to other solar cells. Parameters extracted were power output efficiency of 36.95%, V_{oc} of 1.054 V, J_{sc} of 45.84 mA/cm², and a FF of 76.46%, under simulated illumination of AM1.5g at normal incidence. The structure ensured efficient charge separation, reduced the losses due to recombination, and showed maximum photon absorption for the wavelength range of 300–750 nm. I-V characteristic analysis, absorbance across different wavelengths, along with energy band profile, proved that QDSC was superior in its performance and scalability. This study provided the much-needed insight to design and optimize next-generation solar cells and highlighted the future possibility of QDSCs in advancing renewable energy technologies.

Keywords: Multiple Excitation Generation; Quantum Dot; CdTe Q-Dots; Silvaco TCAD; Energy Conversion Efficiency

Enhancing Sparse Geothermal Gradient Data at Regional Geological Scales using Generative Adversarial Networks

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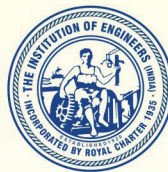
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Abstract: Geothermal energy is a promising sustainable, low-carbon energy source with significant potential for global heating, cooling, and electricity generation. A critical component in assessing geothermal energy potential is the accurate mapping of geothermal gradients. However, current global geothermal gradient datasets are often sparse, particularly in underexplored regions, limiting comprehensive evaluations. This study leverages Generative Adversarial Networks (GANs), a class of deep learning models, to augment sparse geothermal gradient data in the Puga Valley, Ladakh, India — a region with limited existing geothermal data. By incorporating concentrations of radioactive elements (Uranium-238, Thorium-232, Potassium-40) and petrophysical properties (density, porosity, permeability, thermal conductivity, specific heat capacity) as input features, the developed GAN model generates



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