Exploration and verification of photovoltaic cells

Can a model predict the power conversion efficiency of organic solar cells?
Explainable models are used to predict the PCE of organic solar cells The error between model prediction and experimental verification is less than 3% The power conversion efficiency (PCE) of organic solar cells (OSCs) has exceeded 19% with the development of non-fullerene acceptors (NFAs).

How can ML techniques be used to identify photovoltaic Pb-free Haps?
In summary,ML techniques combined with DFT computational data are employed to develop a rapid,goal-driven approachto the discovery of HaPs. Using this method,four stable,Pb-free HaPs with suitable band gaps and highly efficient photovoltaic performance were successfully identified from 177,264 HaPs datasets.

Do non-fullerene acceptors improve power conversion efficiency of organic solar cells?
The power conversion efficiency (PCE) of organic solar cells (OSCs) has exceeded 19%with the development of non-fullerene acceptors (NFAs). Here,machine learning (ML) models based on the inputs of both molecular descriptors and fingerprints with different algorithms are investigated to assist the exploration of NFAs.

Can a deep learning model be used to screen organic photovoltaic molecules?
However,it is extremely expensive to conduct experimental screening of the wide organic compound space. Here we develop a framework by combining a deep learning model (graph neural network) and an ensemble learning model (Light Gradient Boosting Machine),which enables rapid and accurate screeningof organic photovoltaic molecules.

Can deep learning be used to fast evaluate organic photovoltaic materials?
The use of deep learning to fast evaluate organic photovoltaic materials. Adv. Theor. Simul. 2, 1800116 (2019). Scharber, M. C. et al. Design rules for donors in bulk-heterojunction solar cells--towards 10% energy-conversion efficiency. Adv. Mater. 18, 789-794 (2006).

What is a solar photovoltaic (PV) cell?
Solar photovoltaic (PV) cell is a device that can directly convert sunlight into electricity,and global annual solar PV cell production has increased 10-fold from 2010 to 2021,with 78 % of production coming from China in 2021 . It is estimated that the global installation targets of solar PV will reach 2115 GW by 2030.

Four types of Pb-free HaPs solar cells with excellent stability and effi-ciency exceeding 23% were selected, providing an important guidance for the exploration and ...

Hence, reliable PV cell modelling approaches that can accurately replicate output current-voltage (I-V) and power-voltage (P-V) characteristics of photovoltaic (PV) systems have aroused widespread attentions past

few decades, a wide range of PV models have been developed [16] to describe high-nonlinear and multi-modal characteristics of PV systems [16], ...

This academic article comprehensively explores the advancements driving solar PV technology, including significant improvements in solar cell efficiency through innovative ...

The purpose of this paper is to discuss the different generations of photovoltaic cells and current research directions focusing on their development and manufacturing technologies. The ...

To be able to develop a complete solar photovoltaic power electronic conversion system in simulation, it is necessary to define a circuit-based simulation model for a PV cell in order to allow the ...

Solar power generation primarily employs two main methods: solar thermal technology and the utilization of photovoltaic (PV) cells. The former method involves solar energy conversion into heat as a primary step, which can cool the PV cell and improve the performance of the plate [3], [4].The hot air with high kinetic energy indirectly helps to produce electrical ...

Among these alternative energy sources, solar energy is considered as the most promising one because of its inexhaustible and pollution-free [3]. Correspondingly, solar energy is converted into electrical energy by the photovoltaic system [4]. Accurate photovoltaic (PV) models are helpful to improve the performance of PV systems.

Photovoltaic cell has unique features of harnessing solar energy by absorbing the falling irradiance on its surface and converting it into useful electrical energy. In this study a robust model is built with Tag tools in Simulink environment based on mathematical equations considering all the parameters including shunt and series resistance etc. which affects the performance of the ...

In this context, PV industry in view of the forthcoming adoption of more complex architectures requires the improvement of photovoltaic cells in terms of reducing the ...

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McCormick AJ, Bombelli P, Scott AM, Philips AJ, Smith AG, Fisher AC, Howe CJ (2011) Photosynthetic biofilms in pure culture harness solar energy in a mediatorless bio-photovoltaic cell (BPV) system. Energy Environ Sci 4:4699-4709

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