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Research on Photoelectric Model of Battery Assembly

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Abstract
The temperature of solar cells is an important factor affecting the photoelectric conversion efficiency of the battery. The temperature control of the battery is the basic consideration to build a reasonable photovoltaic building integrated system.This paper presents a theoretical model of the photoelectric cell assembly model, analyzes the basic properties of the solar cell in the natural ventilation cooling conditions, analyzes the influence of these parameters on the performance of solar cell, and verify the correctness of the theoretical model.

Keywords:*Battery,Component,Photoelectric Model, Solar Energy.*

1. Introduction

Solar heating combined with the solar battery components and solar collector combined cell module as the absorber collector, and convert solar energy into electricity and heat, to improve the utilization efficiency of solar energy. The electric heating combined system removes the heat generated on the battery assembly through a circulating fluid, thereby solving the problem that the solar cell component reduces the photoelectric conversion efficiency due to the increase of the temperature. The basic components of the electric heating system include three parts: collector, electric energy utilization component and heat energy utilization component. The collector is mainly divided into two types of water and air. The water collector is with water as working fluid in the work, from the structural form, water collector with tube plate structure. Tube plate structure is closely installed in the absorber plate tube plate heat collector of the solar cell module, the connection between the absorber plate and the pipe by welding or close manner with the water as the working fluid in the pipe flow in heat collection. Air collector is a kind of air as working medium. In the structure of the general use of trench structure, that is, under the battery components to leave a gap air, or made into a series of certain width to depth ratio of the gas channel through the air to collect heat.

NOCT model is a steady-state model of a typical prediction of solar cell operating temperature, standard operating temperature of solar cell is a solar cell module in radiation 800W/m2, the environment temperature is 20 DEG C, the speed is 1m/s the environmental conditions, the operating temperature of solar cell.But the application of the model has limitations, the battery components on both sides must have the same environmental temperature and wind speed, the total heat transfer coefficient is constant, the solar cell operating temperature and ambient temperature and solar radiation into a linear relationship. Due to the integration of photovoltaic building, it is difficult to ensure the same environmental conditions on both sides of the component, so different scholars have studied the applicability of this model in the integration of photovoltaic buildings.

2. The Theoretical Model of Energy Balance Analysis

The battery component is divided into three layers, from top to bottom glass cover plate, solar battery, backboard.Figure 1 is the theoretical model of the heat transfer profile, node g, B, C, respectively expressed the battery pack glass cover, solar cells, backplane.

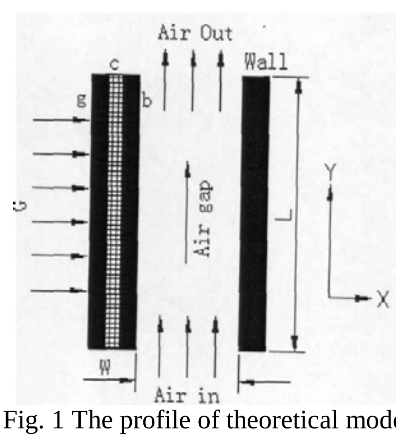


Fig. 1 The profile of theoretical model

In Figure 2 the system resistance network,variable T_α , T_{gr} , T_{sky} , T_g , T_c , T_b , T_f , T_{wo} , T_{wi} , T_{in} denote the environmental temperature, ground temperature, air temperature, average temperature, solar cell cover glass average temperature, average temperature, ventilation flow back air temperature, vertical wall surface temperature, vertical wall surface temperature and indoor temperature.

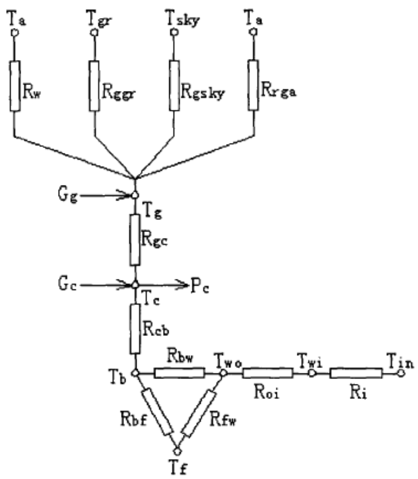


Fig. 2 The thermal resistance network diagram of theoretical model

Energy balance of solar cells is as follows

$$M_c C_c \frac{dT_c}{dt} = GA(1-\alpha_g)(1-r)\alpha_c + H_{cb}A(T_b - T_c) + H_{gc}A(T_g - T_c) - P_c \quad (1)$$

Heat transfer coefficient between solar cells and backplane is as follows

$$H_{cb} = 1/\left(\frac{D_b/2}{K_b} + \frac{D_c/2}{K_c}\right) \quad (2)$$

Photovoltaic conversion efficiency of solar cells is as follows

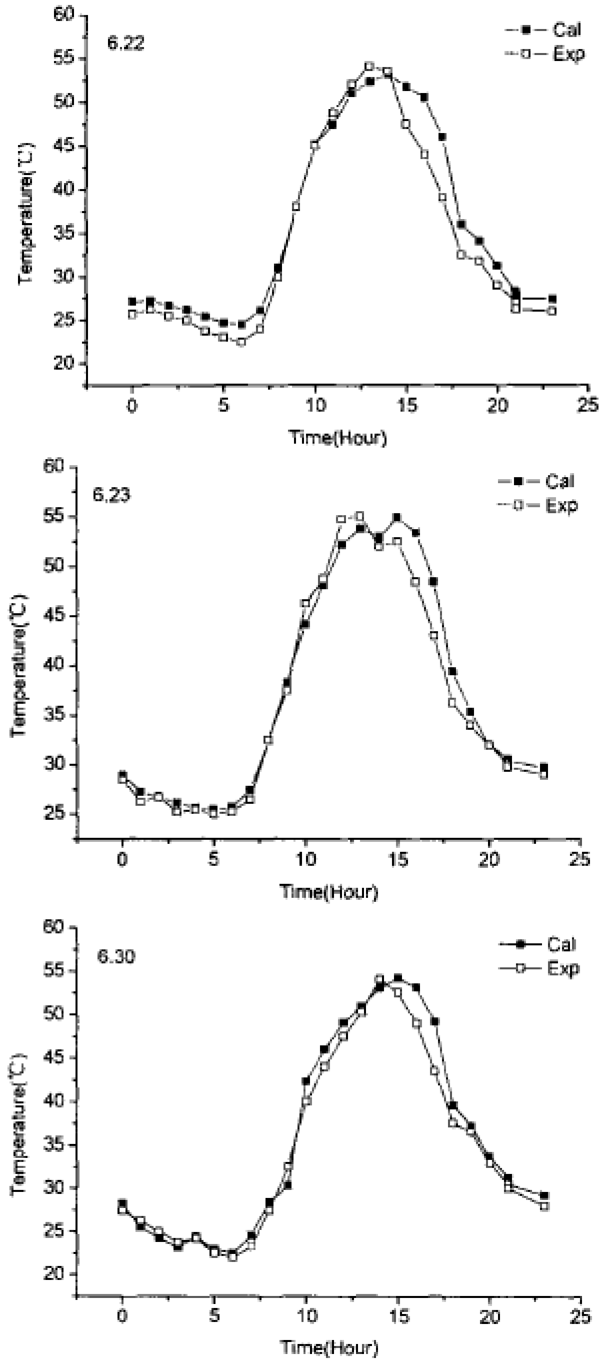
$$\eta_c = \eta_0[1 - 0.0045(T_c - 298)] \quad (3)$$

The output power of the solar cell is as follows

$$P_c = GA(1-\alpha_g)(1-r)\alpha_c\eta_c \quad (4)$$

3. Experiment

Weather data and solar cell experimental data measured in photovoltaic power system test,The experimental data of the battery are compared with the calculated data in the same weather condition,Verify the correctness of the model and solution.The measured results are compared with the simulation results, as shown in figure 3.



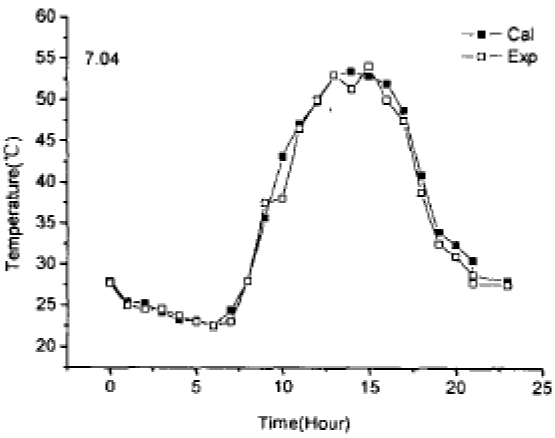


Fig. 3 Comparison of theoretical and experimental values of solar cell temperature.

4.The Performance Analysis of Battery Assembly System

Fig.4 is the relationship between battery output power and battery efficiency, solar radiation.From the figure, with the advance of time, the efficiency of solar cells due to the influence of the temperature of the battery, the efficiency decreased gradually, at about 11 efficiency reaches a minimum value, but the output power of the battery components reached the maximum value, which is mainly due to around 11 solar radiation is maximal, the amount of solar radiation battery the maximum absorption component, the amount of radiation into electricity and battery power, while the lowest efficiency, output power still reaches the maximum value of a day.

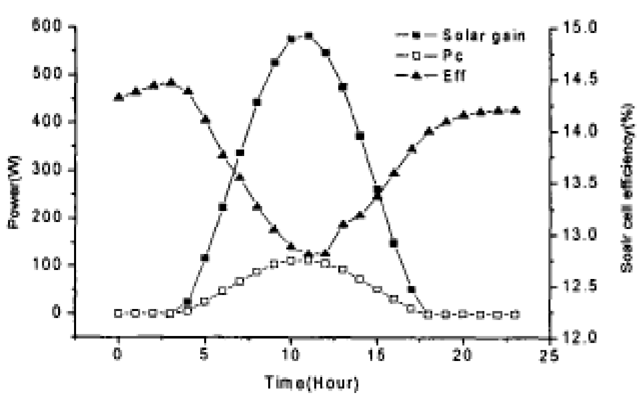


Fig. 4 Relationship between battery output power and battery efficiency, component solar heat gain

Solar gain is a component of solar heat gain. Pc is a battery output power Eff is solar cell efficiency.The Parameters are shown in Table 1,

Table 1: Parameters of simulation

Parameter	Numerical Value
Solar cell absorptivity	0.95
Solar cell emissivity	0.9
Glass cover plate absorption rate	0.06
Glass cover emissivity	0.84
Battery component length	0.95
Battery subassembly width	0.60

The theoretical model of photovoltaic solar cell module system is established, and the performance of the system is simulated and optimized.In the comprehensive simulation analysis, we draw the following conclusions: solar radiation, ambient temperature and ambient wind speed are the main factors affecting the temperature of solar cells.Under typical sunny weather conditions in summer, the temperature of the ventilation channel is higher than the ambient temperature at the highest value. At noon the highest battery temperature, the lowest efficiency of battery power generation, the sun's largest battery heat, the maximum output power of the battery.With the increase of ambient wind speed,The heat of the battery pack carried by air is increasing,The battery temperature significantly decreases, the ambient wind speed increases to a certain value, and the influence of the wind speed on the battery temperature decreases.Suitable environment wind speed has positive effect on solar cell heat dissipation.

5.Conclusions

In this paper, the theoretical model of PV module for photovoltaic curtain wall is established, and the performance of the system is simulated and optimized.n the comprehensive simulation analysis, we draw the following conclusions: solar radiation, ambient temperature and ambient wind speed are the main factors affecting the temperature of solar cells.Under typical sunny weather conditions in summer, the maximum temperature of the ventilation channel is higher than the ambient temperature.At noon the highest battery temperature, the lowest efficiency of battery power generation, the sun's largest battery heat, the maximum output power of the battery. With the increase of wind speed, air away the heat of the battery components increased, decreased significantly the cell temperature, wind speed increases to a certain value, the increase of wind speed decreases continuously to reduce the impact of the temperature of the battery, the wind cooling environment suitable for a solar battery can play a positive effect.

Acknowledgements

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References

[1] Yang Zhao,Yanguang Cai,Defu Cheng, "A Novel Local Exploiation Scheme for Conditionally Breeding Real-coded Genetic Algorithm", Multimedia Tools and Applications, 2016.In Press.

[2] Liya Wang,Yang Zhao,Yaoming Zhou,Jingbin Hao, "Calculation of flexible printed circuit boards (FPC) global and local defect detection based on computer vision", Circuit World, Vol. 42, No. 2, 2016, pp. 49-54.

[3] Jianting Li,Xiao Ma,Yang Zhao, "On Anti-Periodic Solutions for High-Order Cohen-Grossberg Neural Networks with Bounded Delays",Journal of Computational and Theoretical Nanoscience, Vol.12, No.11, 2015, pp.4593-4600.

[4] Shuo Xiao,Yang Zhao,Jiayu Zhuang,Wei Chen, "Stability Result of Time-Dependent Variational Inequality", Journal of Computational and Theoretical Nanoscience,Vol.12, No.11, 2016, pp.4549-4552.

[5] Yandong Zhang,Yang Zhao, "Design & implementation of an Air Quality Monitoring System for Indoor Environment based on Microcontroller", International Journal of Smart Home, Vol. 9, No.11, 2015, pp. 301-312.

[6] Yang Zhao,Yanguang Cai,Guobing Fan,"Dynamical Behavior for Fractional-order Shunting Inhibitory Cellular Neural Networks",Journal of Nonlinear Science and Applications,Vol.9,No.6,2016, pp. 4589-4599.

[7] Yang Zhao,"Research on Active Control of the Dynamic Vibration for Underwater Robot", Journal of the Balkan Tribological Association,Vol.22,No.1A,2016,pp770-779.

[8] Bing Liu,Yang Zhao,Yuanyuan Dang, "Data flow network security strategies based on data mining",Metallurgical and Mining Industry, Vol.7, No.10, 2015, pp. 46-53.

[9] Yang Zhao,Yanguang Cai,Xiaojun Yang,"A Local Fractional Derivative with Applications to Fractal Relaxation and Diffusion Phenomena",ThermalScience,Vol.20,No.S3,2016,pp723-727.

[10] Hanqing Tao,Yang Zhao, "Intelligent fault prediction of railway switch based on improved least squares support vector machine",Metallurgical and Mining Industry, Vol.7, No.10, 2015, pp.69-75.

[11] Huiling Guo,Wengang Zhou,Yang Zhao, "A license plate recognition algorithm based on image processing technology",Metallurgical and Mining Industry, Vol.7, No.8, 2015, pp.322-328.

[12] Liya Wang,Jiankun Shang,Yang Zhao, "Information Prediction of the trend of network attacks based on mechanism analysis method",Metallurgical and Mining Industry, Vol.7, No.8, 2015, pp.328-334.

[13] Zongyi Xing,Xinrong Liu,Yang Zhao,Yong Qin,Limin Jia, "Optimization of Vibration Damping for the Power Assembly Suspension System Based on Ant Colony Algorithm",International Journal of Simulation,Systems, Science & Technology, Vol.21, No.5, 2016, pp.281-289.

[14] Huiling Guo,Yan Hou,Yang Zhao, "Research on Image Matching Algorithm based on TPS Transformation Model",International Journal of Simulation,Systems, Science & Technology, Vol.17, No.8, 2016, pp.102-110.

[15] Wengang Zhou,Huiling Guo,Yang Zhao, "A Novel Method for Detecting Similar Microblog Pages based on Longest Common Subsequence",International Journal of Simulation,Systems, Science & Technology, Vol.17, No.8, 2016, pp.111-118.