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# Application of Nanofluid in Photovoltaic Panels –A Review

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***Abstract: In Photovoltaic thermal (PVT) System, Nanofluid and its structure plays an important role in cooling photovoltaic panels. It is introduced as a non-conventional active/passive cooling method to improve the performance of the PVT system. A PVT system consists of several components such as solar panels to absorb and directly convert sunlight into electricity, ducting for fluid flow, supporting structure and accessories. A Nanofluid is a mixture of base fluid and nanometre sized particles such as metals, oxides and carbides. In the current work, attempt is made to review application of Nanofluid in the PVT system for better energy conversion efficiency.***

***Keywords: Nanofluid; Hybrid PV/T System; Thermal conductivity; PV/T Performance; PV/T Cooling***

## I. INTRODUCTION

The energy from the sun can be converted into heat or electricity with the help of solar collector. With compare to low grade energy (heat) extraction in the form of high grade energy (electricity) is always preferred due to wide range of application and conversion efficiency. With the discovery of photovoltaic effect, solar energy can be easily converted into Electrical Energy with help of Photovoltaic cells. At present, the Photovoltaic cells have lower conversion efficiency which is less than 20% and remaining 80% of energy converted in the form of thermal energy.

The thermal system has comparatively good efficiency but has lower grade of energy. The main reason behind the decrease in electrical efficiency of the PV panel is the increase in the module temperature of the PV. As due to Overheating of PV/T cells causes Reduction in Efficiency.

The dissipation of heat can be done by supplying Nanofluid through duct or piping arrangement. NanoFluids are Solid-Liquid Composite materials which has the Ability to transfer heat across a small temperature difference. It enhances the efficiency of Energy Conversion. It contains Nanometer sized particles called Nano-Particles. Nanofluids are new generation Heat Transfer Fluids for various types of Applications.

## II. SYNTHESIS OF NANO FLUID

Two methods have been applied for the preparation of the nanofluids: one step and two step method. Most of the nanofluids are prepared by the two step method in which the nanoparticles are prepared by chemical or physical method then the nanoparticles are added in the base fluid. The nanoparticles were obtained and were dispersed into a base fluid in a mixing container. Then by intensive ultra sonification these nanoparticles are mixed with base fluid. The nanoparticles like Al2O3, CuO, TiO2 containing oxides can be prepared easily.

## III.NEEDS OF NANO FLUID

*A.* In Heat Transfer Applications.
*B.* Important role in Improving Heat transfer Behaviour of Fluids.
*C.* Significant change in the properties of Base fluid by suspension of nanoparticles.
*D.* It is most suitable for Heating and Cooling Applications.

## IV. APPLICATION OF NANO FLUID

*A.* Industrial sector for Heat Exchanging Devices.
*B.* Cooling of Automobile Engines, Welding Equipments.
*C.* Automotive Applications:-Engine oils, Automatic transmission fluids, coolants, Lubricants.
*D.* Electronic Applications:-for cooling of Microchips in computers, laptops etc.

## V. LITERATURE SURVEY

Jee Joe Michael, S. Iniyan [1] performed anaylysis of copper sheet laminated photovoltaic thermal collector using copper oxide-water nanofluid. The tests are conducted for 0.01 kg/s and the results compared between Cu/O water nanofluid and water. The outcome of this analysis was increase in thermal efficiency up yo 45.76 %.Based on the observation it is seen that the electrical efficiency reduced using Cu/O, if the heat exchanger is re-designed for the new nanofluid then the thermal and electrical efficiencies can be improved.

Ali Najah Al-Shamani et al. [2] investigated the way to improve the performance of the PV panel .The PVT collector fabricated and designed in Malaysia tropical climate conditions. The three different types nanofluids are considered for the experiment (SiO2,TiO2 and SiC).The results showed that the PVT collector with SiC nanofluid highest photovoltaic thermal efficiency about 81.73 % and the PVT electrical efficiency of 13.52 % with overall energy coefficient of 0.93 with flow rate of 0.170 kg/s.

H.A. Hussein et al. [3] Proposed investigation on the performance enhancement of PVT panel using a Tracking System and Nanofluid .A PVT system design and implemented by them which consists of the copper pipes on the backside of PV panel with cooling fluid arrangement. The outcome of this analysis is increase in the electrical efficiency of PV cells about 30 %. The work shows that mass flow rate of the flowing fluid affect the electrical efficiency and optimum results were seen for 0.2 L/S.

Barot Vishalkumar G, K. D Panchal [4] introduces nanofluid as tool to introduce the efficiency of solar collector by using CuO and Al2O3 as nanofluid with the various concentrations in the base fluid. The results shows increase in the instantaneous efficiency 0.88 to 2.88 %, 1.24 to 6.28 % respectively for CuO and Al2O3 nanofluid. It has been seen that thermal efficiency also increased from 0.95 to 3.05%, 0.65 to 3.46% for mass flow rate of 20 and 40 L/Hr.

E. Elayarani et at. [5] Observed that the PVT collector gives better performance with nanofluid having higher volume concentration because of the thermal conductivity. It was seen that for 0.1 %, 0.3 %, 0.5 % volume concentration the overall PV cell efficiency increased in the order of 12 %, 14 %, 17 %.

Farideh Yazdanifard et al [6] performed an experimental setup with TiO2-water as Nanofluid. Blending was taken 2% by volume. By increasing the pipe length from 0.5 to 5m decreased the total energy efficiency while it increased the total exergy efficiency, The pipe diameter has a negligible impact on the system performance ,By applying nanofluids in laminar flow is more effective than turbulent ,whereas employing nanofluid in CPV/T system is more efficient compared to the PV/T system. It increased Electrical Efficiency by 10.62% and Thermal Efficiency by 68.50%.

K.Sopian et al [7] did an Experimental study by Optimizing Nanofluids with the optimum Round tube Design by using SiO2-Water as Nanofluid. Best round tube absorber designed is R20mm-SiO2 for mass flow rate 0.170(kg/s. The electrical and thermal efficiency of PV/T Hybrid system was increased by 13.67% and 73.78%.

J. Cieslinski et [8] al did an investigation on hybrid PVT cooled by water-Al2O3 Nanofluid. It was observed that by using water-AL2O3 as nanofluid resulted in lower thermal efficiency than distilled water. No noticeable effects seen on the overall efficiency by using water-Al2O3 Nanofluid.

W. Mustafa et al [9] evaluated the performance of PVT by using a Numerical and mathematical model. Three different volume concentration of titanium oxide ranging from 0.5-1.5 %Vol were used. It concluded that lower volume concentration give better Thermal and Electrical efficiencies and hence 0.5%Vol give the highest efficiency. An observation was also made that thermal and electrical efficiencies strongly depend on mass flow rate and are inversely proportional to solar irradiance and an addition of small nanoparticles lead to enhancement of thermal properties and lower volume concentration gave best performance.

M. Gadhiri et al [10] experimentally investigated that when 1 and 3 % concentration by weight of the distilled water and ferrofluid (Fe3O4) improve the overall efficiency of the PV panel. The results show that the 3% of concentration increase the overall efficiency about 45 %.

## VI. CONCLUSIONS

Various authors have carried out studies on the improvement of heat transfer of the Nanofluid. A variety of the nanofluids are prepared by one or two step method. The mostly used base fluids are water and ethylene glycol. It was seen that, with application of nanofluid in PVT, increases electrical efficiency and overall performance. It was also understood that, nanofluid helped to maintain desired temperature of PV panel.

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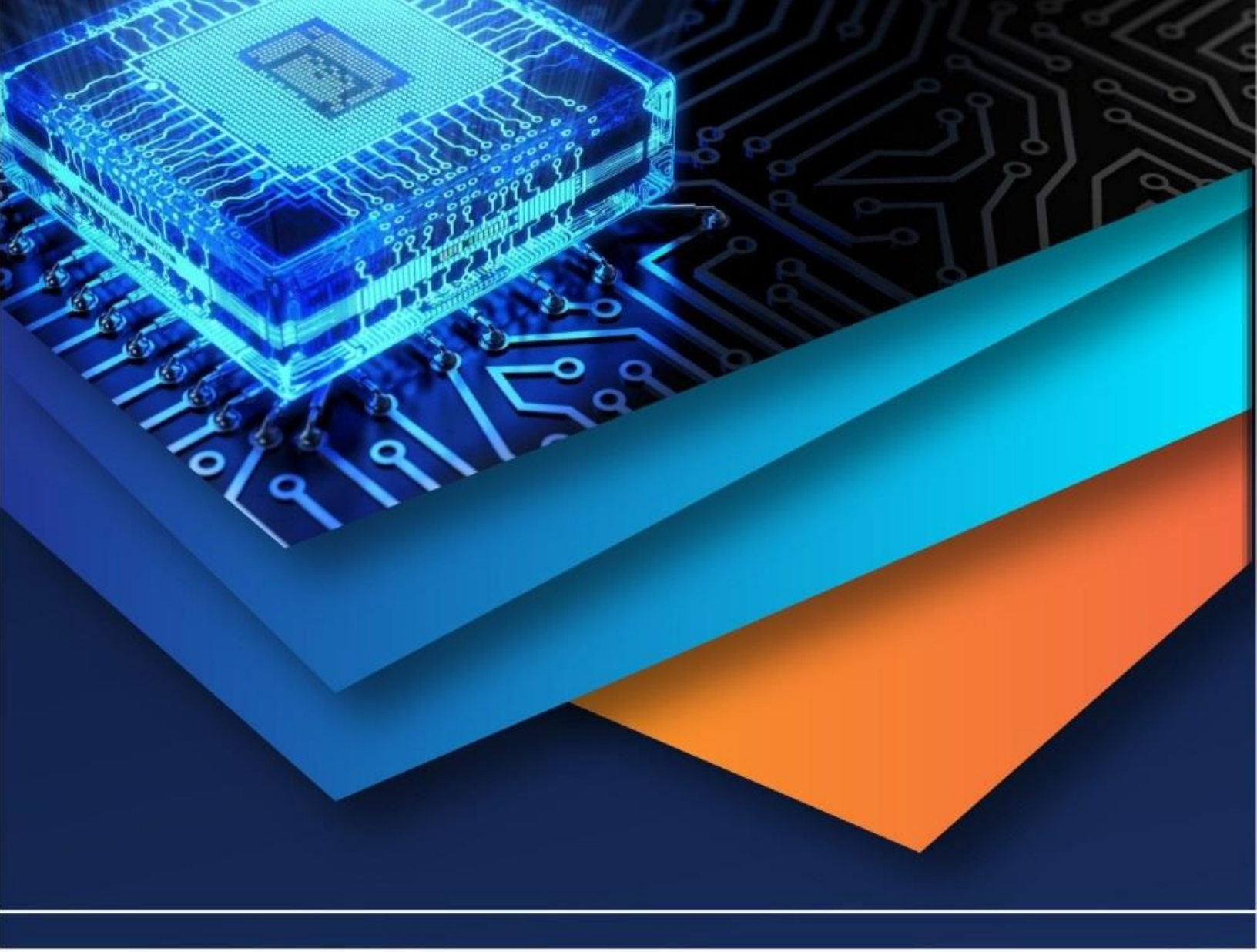

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