



# SECOND INTERNATIONAL CONFERENCE ON INNOVATIONS IN CLEAN ENERGY TECHNOLOGIES

## ICET 2023



**8-10 April, 2023**

### About ICET 2023

The objective of this International Conference on Innovations in Clean Energy Technologies "ICET 2023" is to provide a platform for researchers, engineers, academicians and industrial professionals to present and discuss smart green technologies for sustainable future with recent advances, trends, and development which is taking place all across the globe.

### About MANIT Bhopal

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# Performance Study of Titanium di-oxide Nanomaterial based Perovskite Solar Cell and comparison with organic Die Sensitized Solar cell

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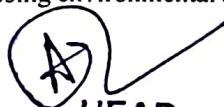
## Abstract.

The major source of green energy is solar energy. Many ways were explored and under research for harnessing this solar energy. Silicon Photovoltaic cell is a well-developed technology which is easy, efficient and economic mode of converting the solar energy into electricity. This has efficiently been utilized worldwide. In addition to this, chemical solar cells like perovskite solar cell and dye sensitized solar cell has also been evolved and researched for conversion of solar energy to electrical energy. These cells could be successfully utilized irrespective of poor strength of incident radiation. These types of solar cells are under research and still commercial development is not progressed. In this paper, the perovskite solar cell is manufactured in the lab for three different area 1 cm<sup>2</sup>, 11.25 cm<sup>2</sup> and 45 cm<sup>2</sup>. The perovskite solar cell is completely chemical based solar cell. The developed cell will further be experimented in the open sun light during the period of summer when approximate light intensity reaches 1350 W/m<sup>2</sup>. The experimental observations at different interval of time are recorded and performance parameters such as voltage, current intensity, power output and efficiency of the system are evaluated. The performance of the cell will further be compared with the organic dye based sensitized solar cell. The result shows that the performance of perovskite solar cell will be area dependent showing increment with increase in area of cell. However the die sensitized solar cell move ahead of perovskite solar cell in achieving better power output and efficiency.

**Keywords:** perovskite, dye sensitized, solar cell, solar photovoltaic, incident radiation.

## 1 Introduction

The electrical energy becomes the basic need of human being in this 20<sup>th</sup> century [1]. The global energy demand is substantially increased during last few years. The main reason may be the dependencies of human on electrical appliances in day-to-day life, electricity consumption for electrical vehicles and industrial revolution are the sectors where continuous source is required. The available fossil fuel-based power plants are not mitigating this energy demand. Due to the depletion of these non-renewable fuels, there is increase in operational cost of the power plant. This crisis of electrical energy alarms the world to explore alternative sources of energy which are renewable and easily available. Few of such renewable sources are wind Turbine farms, Solar photovoltaic cell farm are well established and fulfill the need of society to certain extent [2]. However, to harness abundant energy available from sun, there must be some sources which are cost effective, easy to manufacture and implementation. One of its kind is the Perovskite Solar Cell(PSC). Perovskite cell uses the nanoparticle based TiO<sub>2</sub> paste as the semiconductor material. This cell is a structure that makes use of a perovskite crystals. Perovskite substances majorly utilized are methylammonium lead halides and all-inorganic cesium lead halides. These materials are less expensive and handy to make. Yang et al. uses laminating process to fabricate the perovskite cell [3]. They use the electrodes that are transparent Indium Tin Oxide (ITO) layer so that the device can receive light from both sides. SnO<sub>2</sub> acts as an electron transport layer (ETL) and NiO is the Hole Transport Layer (HTL). Du et al, 2022 modelled the flexible perovskite solar cell to understand the influence of bending angle and direction. Due to silica subwavelength array on surface of flexible substrate, the current density of perovskite cell was improved by 73% at different bending angle [4]. Mahbub et al. utilizes the basic PSC structure which contains lead, the material loses durability, and lead is poisonous, posing environmental and health risks [5]. Cu<sub>2</sub>O was used as a suitable HT Layer



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