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Maximum Power Point Tracker Optimization for Photovoltaic Systems based on III-V Elements.

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Summary

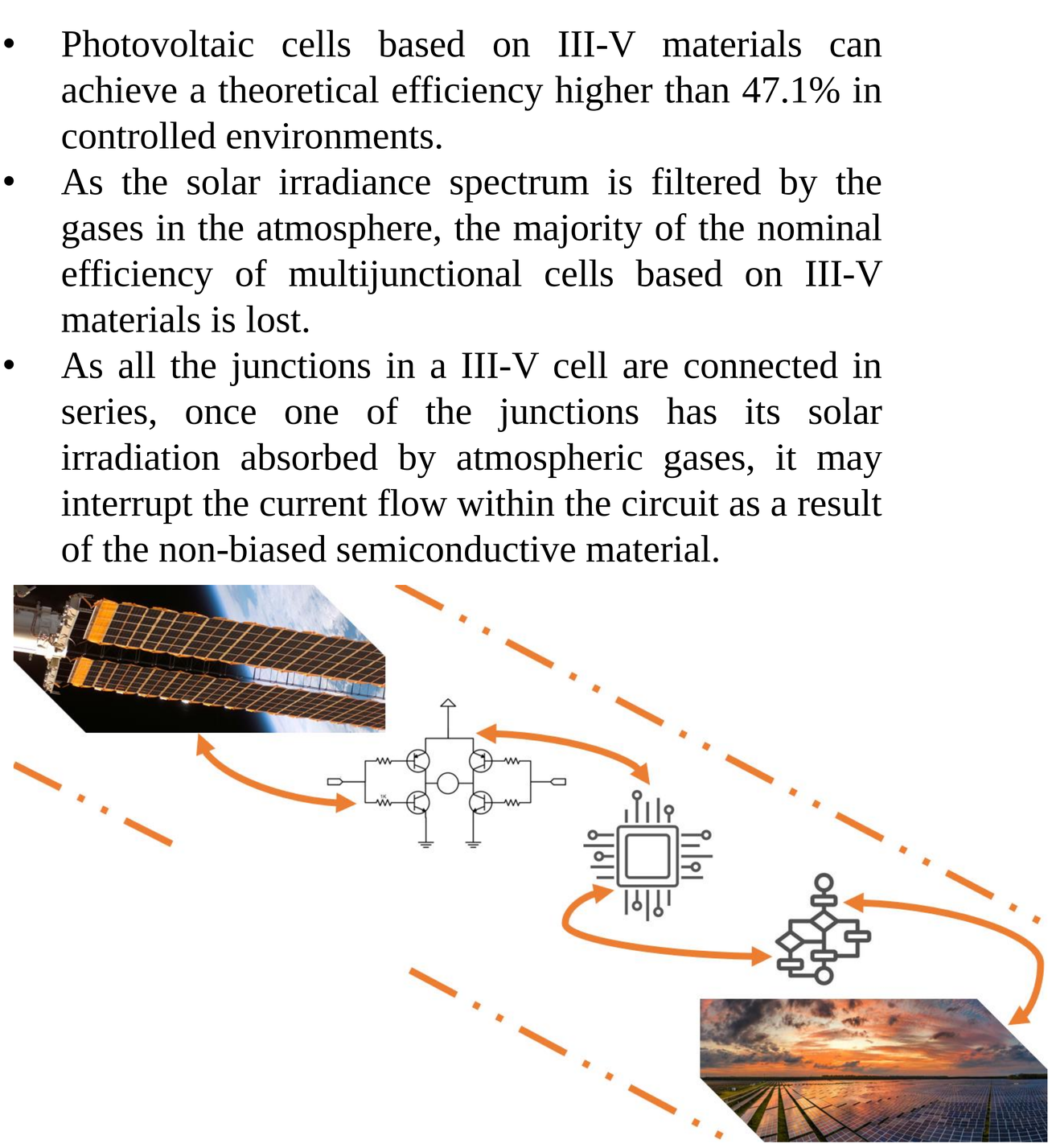
- This paper summarizes the technological trend of photovoltaic cells which lead to the development of multijunction photovoltaic cells based on III-V elements.
- Describes the challenges within the implementation of multijunction cells based on III-V elements into terrestrial applications will be discussed.
- Present potential solution to counter the efficiency loss of photovoltaic cells based on III-V when implemented in terrestrial applications.

Introduction

- As the solar irradiance spectrum is filtered by the gases in the atmosphere, the majority of the nominal efficiency of multijunctional cells based on III-V materials is lost.
- To address the hardware losses, a solution based on the optimization of the Maximum Power Point hardware to adjust the optimal power point as quickly as possible will be explored.

Photovoltaic cells

- Photovoltaic cells based on III-V materials can achieve a theoretical efficiency higher than 47.1% in controlled environments.
- As the solar irradiance spectrum is filtered by the gases in the atmosphere, the majority of the nominal efficiency of multijunctional cells based on III-V materials is lost.
- As all the junctions in a III-V cell are connected in series, once one of the junctions has its solar irradiation absorbed by atmospheric gases, it may interrupt the current flow within the circuit as a result of the non-biased semiconductive material.



MPPT optimization for multijunction photovoltaic cells based on III-V elements

- The usage of MOSFETs based on SiC and GaS might be an ideal approach to match the frequency response of photovoltaic cells based on III-V elements.
- The utilization of ANN would stress the microcontroller. Therefore, resulting in potential delays in the response due to the wide data process which refers to the circuit status with a predetermined set of parameters, based on a database.
- The implementation of P&O algorithm with fixed step size, will not be able to achieve the frequency variation required, due to the small step increment or decrement.

Conclusion

- The usage of Maximum Power Point Trackers with a variable step-size algorithm, proportional to the difference between the current at the maximum power point (Impp) and acquired instantaneous current, combined with adaptive-perturbation-frequency in a P&O algorithm might be the optimal approach to overcome the efficiency losses of photovoltaic systems using cells based on III-V elements.