



Development of Photovoltaic Materials for High-Efficiency Solar Cells in Tropical Climates: An African Perspective

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Abstract

Photovoltaic materials are essential for converting sunlight into electricity in various climates, including tropical ones like Nigeria's. A systematic literature review was conducted using databases such as Web of Science, Scopus, and Google Scholar. Keywords included 'photovoltaic materials', 'solar cells', 'tropical climates', and 'Nigeria'. Studies published between and were considered. The review identified a trend towards the use of perovskite-based materials for solar cell development, with some studies reporting efficiencies exceeding 20% in tropical conditions. However, there is limited data on material degradation under high humidity and temperature. While significant progress has been made in developing photovoltaic materials suitable for tropical climates, further research is needed to enhance the stability of these materials under challenging environmental conditions. Investigate the long-term performance of perovskite solar cells in Nigeria's climate and develop cost-effective manufacturing processes. Collaboration between researchers and industry stakeholders should be encouraged to accelerate technology transfer. The empirical specification follows $Y = \beta_{0+\beta}^{-} p X + varepsilon$, and inference is reported with uncertainty-aware statistical criteria.

Keywords: *Tropical, Photovoltaics, Materials Science, Efficiency, Thin Films, Semiconductors, Reviews*

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