

Material and Electrical Defects in Photovoltaic Systems-Environmental Impacts and Challenges

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Abstract

Photovoltaic (PV) systems, crucial for sustainable energy generation, often suffer from various material and electrical defects that can significantly hinder their performance and longevity. Material defects such as microcracks, delamination, and degradation of encapsulants affect the mechanical integrity of PV modules, leading to efficiency losses and increased failure rates. Electrical defects, including hotspots, mismatched cells, and connection issues, further exacerbate these problems, reducing the overall power output and system reliability. These defects not only compromise the efficiency of energy conversion but also have broader environmental implications. Increased failure rates necessitate more frequent replacements and disposal of PV modules, contributing to electronic waste and resource consumption. Furthermore, the energy payback time of PV systems is extended, delaying the environmental benefits of transitioning to renewable energy sources. Understanding the nature and impact of these defects is crucial for improving PV system durability and maximizing their environmental contributions.

Keywords

Electrical Defects, Sustainable Energy, Environmental Impacts