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Peer Review

Review of: "A Brief Review of the Optoelectronic Properties of Delafossite Materials for Solar Cell Applications"

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This manuscript provides a comprehensive review of delafossite materials, highlighting their synthesis methods, crystal structure, and optoelectronic properties for next-generation solar cells. These materials, composed of abundant and non-toxic elements, offer significant environmental and economic advantages, making them attractive for photovoltaic applications. Addressing the comments below will make this work more suitable for clarity.

1. What are the key advantages of delafossite materials that make them suitable for next-generation solar cells?
2. How do environmental and economic factors influence the pursuit of delafossite-based solar cells?
3. What synthesis methods have been explored for delafossite materials, and how do they impact material properties?
4. How does the crystal structure of delafossite materials contribute to their optoelectronic performance?
5. What are the reported values for key solar cell parameters (Jsc, Voc, efficiency) under different fabrication conditions?
6. How do delafossite materials function as photocathodes and photoanodes in p-type dye-sensitized solar cells (DSSCs)?
7. In what ways can delafossite materials serve as absorber layers and hole transport layers in solar cells?
8. How does the tunability of the band gap in delafossite materials enhance their potential for maximizing power conversion efficiency?

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9. What challenges exist in synthesizing delafossite nanoparticles with optimized properties for solar applications?
10. How do the reported efficiencies of delafossite-based solar cells compare to those of conventional photovoltaic materials?
11. What are the limitations in current synthesis techniques, and what improvements are required for better solar cell performance?
12. What are the stability considerations of delafossite materials in long-term solar cell applications?
13. Are there any cost-related challenges associated with the large-scale synthesis and deployment of delafossite solar cells?
14. How does the choice of synthesis method influence the defect density and carrier mobility of delafossite materials?
15. What future research directions are suggested for improving the efficiency and applicability of delafossite-based solar cells?
16. Consider adding a section comparing the performance of delafossite materials with other commonly used photovoltaic materials such as perovskites, silicon, and CIGS. This would help contextualize their advantages and limitations.
17. A dedicated section discussing the current challenges in delafossite-based solar cells, such as synthesis limitations, stability issues, and efficiency improvements, along with potential solutions, would add depth to the review.
18. Since delafossite materials have diverse optoelectronic properties, a section highlighting their potential applications beyond solar cells, such as in photocatalysis, sensors, and transparent electronics, could make the review more comprehensive.

Attachments: available at https://doi.org/10.32388/HF4BAL

Declarations

Potential competing interests: No potential competing interests to declare.