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| **Abstract:** |  |
| Over the last few decades, remarkable progress in achieving stable power efficiency of Perovskite Solar Cells (PSCs) has made researchers recognize their substantial potential in mitigating the global energy crisis. In this paper, the currently thriving research trends of perovskite solar cells are reviewed from the perspective of both environmental impacts and cost effectiveness. After a brief review of the main design challenges rising from the instability and toxicity of PSCs, a performance analysis of the notably efficient and cost-effective PSC designs in recent research literature is conducted. The continuous stability improvement of PSCs over the years is discussed, detailing crystal structure modification, film quality improvement, encapsulation, band alignment, strain engineering, and other defect reduction strategies. The environmental considerations for PSC design are covered next, encompassing toxicity reduction strategies and lifecycle assessments for assessing important environmental and energy impact parameters of energy payback time (EPBT) and greenhouse gas (GHG) emissions. The feasibility of commercializing PSCs is also assessed by the technoeconomic analyses in literature that compare minimum sustainable price (MSP) and levelized cost of energy (LCOE) of PSCs to that of other technologies. Finally, the observations are used to identify future prospects and emerging trends of PSC research. It can be observed that perovskite solar cells, especially tandem cells reaching record efficiency of 34.6% exceeding the Shockley-Queisser efficiency limit, have become prime candidates for developing sustainable energy solutions on a large scale. | |