

ABSTRACT

The need to reduce photovoltaic cell manufacturing and project development costs while focusing on providing cheap and highly efficient photovoltaic cells has led to the emergence of innovative technological advances in the photovoltaic cell materials and fabrication. This study carries out a systematic overview of the latest design technologies in the solar cell materials, shape and layout that have emerged and recorded high efficiencies. For each emerging solar cell technology, the most recent advances are outlined with their respective achieved theoretical efficiencies. Besides the silicon-based solar cells that have been highly commercialized with less than 20% theoretical power conversion efficiency (PCE) and currently having the largest market share, it has been found that the emerging technologies in solar cell materials and fabrication have recorded significantly improved efficiencies of up to 47%. Based on the ongoing research and developments in the engineering of photovoltaic cell materials, renewable solar energy promises a huge potential and growth towards global energy sustainability and this paper provides a guide in the policy making, commercialization and future investments in solar energy.