



ENI AWARD 2024

Energy Frontiers

Nam-Gyu Park

Winner

Discovery of practical solid-state perovskite solar cells

Research Description

Prof. Nam-Gyu Park's Pioneering Research in Perovskite Solar Cells: Transformative Impact and Future Prospects - In 2012, Prof. Nam-Gyu Park revolutionized the field of photovoltaics by demonstrating the first long-term stable solid-state perovskite solar cell with a power conversion efficiency of 9.7%. This groundbreaking discovery was reported in Scientific Reports and marked a significant milestone in solar energy research. Prof. Park's work involved using a methylammonium lead iodide perovskite light absorber adsorbed on nanocrystalline titanium dioxide, with an organic hole conductor infiltrated into a mesoporous titanium dioxide film. This configuration not only achieved a remarkable efficiency but also showed 500-hour stability without encapsulation, addressing the instability issues that plagued previous perovskite-sensitized liquid junction solar cells. *Short-Term Impact* - Prof. Park's research triggered a new era in photovoltaic technology, leading to rapid advancements in perovskite solar cells. By solving the stability problem, his work paved the way for further efficiency improvements, culminating in perovskite solar cells achieving efficiencies of 26.1% as of today, surpassing those of traditional thin-film solar cells based on CIGS and CdTe. This breakthrough has immediate implications for the solar energy industry, offering a more efficient and potentially cost-effective alternative to existing solar technologies. *Long-Term Impact* - In the long term, the advancements in perovskite solar cells hold the potential to transform the global energy landscape. With continuous improvements in efficiency and stability, perovskite solar cells could become a dominant technology in renewable energy, reducing reliance on fossil fuels and contributing significantly to the fight against climate change. Additionally, Prof. Park's research has implications beyond photovoltaics. For instance, his work on using perovskite materials for highly sensitive X-ray detectors, as published in Nature in 2017, demonstrates the versatility of perovskites in various technological applications. *Future Prospects* - Prof. Park's continued

contributions to the field, such as his discovery of moisture-tolerant crystal facets in 2023, which led to perovskite solar cells retaining over 95% of their initial efficiency after 2000 hours in humid environments, further enhance the practical viability of these cells. His innovative approaches, including the development of highly reproducible and efficient perovskite films and the grain boundary healing process, have driven efficiencies to new heights, with significant implications for both commercial and residential solar power generation. In conclusion, Prof. Nam-Gyu Park's pioneering research on perovskite solar cells has not only achieved remarkable scientific milestones but also holds immense potential to impact everyday life. By making solar energy more efficient, stable, and affordable, his work contributes to a sustainable future, highlighting the transformative power of innovative research in addressing global energy challenges.