

Current Status and Research and Technology Opportunities in Photovoltaics

Angus Rockett

Professor of Metallurgical and Materials Engineering

Colorado School of Mines

Professor Emeritus of Materials Science and Engineering

University of Illinois at Urbana Champaign

This talk reviews the various photovoltaic technologies, recent advances in thin films, and opportunities for research to further photovoltaic energy. Worldwide, photovoltaic and wind generation is growing faster than any other technology with wind mostly in very large scale systems. The International Energy Agency projects that wind and photovoltaics will be the dominant electric power generation technology worldwide in 2024, surpassing coal and natural gas. Photovoltaics continue to take advantage of the range of the option of practical application from very large to very small scales. In photovoltaics, silicon continues to dominate the market with great success in very high efficiency devices. In thin films, CdTe and Cu(In,Ga)Se₂ continue to be viable competitors, although the efficiency achieved in Si commercial products increasingly challenges these. The hybrid perovskites remain the most exciting new technology but continue to face stability challenges that may limit their viability long-term. The existing single-junction technologies are approaching their practical limits and tandem structures are of increasing interest and now represent a major focus of research, particularly hybrid perovskites combined with silicon. Finally, energy storage capabilities are increasing rapidly and represent enabling technologies for both wind and solar. Batteries and fuel cells continue to improve and their capacity in the world energy grids are growing fast. Each of these technologies have important research opportunities. The talk finishes with a brief review of the Rockett group's recent highlights in Cu(In,Ga)Se₂, CdTe, and hybrid perovskite materials and device research.