

Chemical & Biological Engineering Department: 3rd Year Talk Series

Date: Friday, April 3rd . Time: 10:30-11:00 AM

Keynote speaker: Sherif A. Khalifa

Title: Environmental Sustainability of Emerging Solar Photovoltaic (PV) technologies.

Abstract:

Solar photovoltaics is largely perceived as a clean energy source. While this is generally true in comparison to conventional energy, it is critical to understand the real environmental consequences from a life cycle thinking perspective to aid in more informed design and deployment decisions. We apply this thinking in two areas of most need: sustainability of large-scale deployment of state-of-the-art Perovskite solar cells and End-of-Life (EoL) PV panel management. Efficiencies of lead halide perovskite photovoltaics (LHP PVs) have increased to 25% just 10 years after their inception, positioning them to compete with current PV technologies developed over decades. LHP PVs have witnessed progress in their scalable manufacturing and improved operational stability achieved with best performing mixed organic-inorganic cations in perovskite structures. This progress makes LHP PV's on track for commercialization within the next few years. We employ a holistic methodology known as life cycle assessment (LCA) that considers the environmental footprint of associated process stages leading to the emerging product creation in a cradle-to-gate framework. We will report our results for the environmental impacts of mixed-cation perovskite ink preparation for large scale deployment. We will also address the supply chain concerns for cesium metal.

On another sustainability perspective, an estimated 78 million metric tons of global PV panels will reach their End-of-Life (EoL) phase in the next 10-15 years. Recycling strategies will be needed to recover some of the critical raw materials and high-embedded energy materials that go into panel manufacturing. In collaboration with the National Renewable Energy Laboratory (NREL), we developed the PV Circular Economy for Energy Materials (CEEM) model that employs a dynamic material flow accounting approach through a 50-year time to understand the environmental consequences of EoL panel management process decisions aiding to achieve circular economy.