

Environmental Research, Technology Demonstration and Conference Project

ECF Project:	ECF 2018-64
Project Title:	Recycling and re-utilisation of toxic materials in solar cells for promoting sustainable energy use and environment protection
Principal Investigator:	Professor Choy Chik Ho, Wallace, Professor, Department of Electrical and Electronic Engineering, The University of Hong Kong
Total Approved Grant:	\$499,000
Duration:	1/7/2019 to 31/12/2021
Project Status/Remarks:	Completed
Project Scope:	<p>The objectives of this project are –</p> <p>To establish a non-toxic and universal (device-structure- independent) extraction approach. The project team will propose an efficient and universal non-toxic approach regardless of the different structures of thin film solar cells to extract the targeted toxic materials from defective, broken or degraded solar cells;</p> <p>To purify the extracted toxic materials for re-use purposes. The extracted materials will be purified by the concept of material recrystallisation through designing a special chemical approach. Importantly, the project team aims to demonstrate the recrystallisation process by using non-toxic solvents;</p> <p>To re-utilise the recycled materials. Together with the project team’s solid experiences in designing and fabricating solar cells, the purified toxic materials will be used to fabricate high-efficiency thin film solar cells; and</p> <p>To establish the conclusive recycling and re-utilisation approach. Finally, the project team will offer a non-toxic, simple and low-cost allsolution processing package to recycle, purify and re-use the toxic materials from defective, broken or degraded solar cells, which will not only directly address the toxic issue of thin film solar cells for environmental protection but also promote the efficient use of green solar energy.</p>
Summary of the Findings/Outcomes:	<p>Developing low-carbon sustainable and green energy technologies has become urgent and significant for achieving sustainable and environment energy source. Recently, perovskite thin-film solar cells (PVSCs) have drawn tremendous attraction because both the Primary Energy Demand and Energy Payback Time are only 1/10 (i.e. cheaper and easier than) that of traditional silicon cells. One of the concerned issues for promoting PVSCs is the toxicity and environmental impact of lead (Pb) based materials primarily dominated by lead iodide. Consequently, developing general and non-toxic process for recycling and re-using lead iodide from various device structures is of critical importance for promoting environmental protection and green/ renewable solar energy.</p>

	<p>The project team addressed the concern by (1) establishing the general non-toxic solution approach to recollect lead iodide from leadbased perovskite materials in solar cells, (2) purifying and recrystallizing lead iodide, (3) fabricating solar cells and show good power conversion efficiency by using recycling materials, and (4) concluding the approach for recycling the materials from used perovskite solar cells and demonstrate newly fabricated solar cells from recycled materials.</p>
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