Environmental Research, Technology Demonstration and Conference Project

ECF Project:	ECF 2020-13
Project Title:	Surface engineering of large-size 3D porous micro-nanostructures for synergistic solar-driven seawater evaporation and hydrogen production
Principal Investigator:	Professor Ho Chung Yin Johnny, Department of Materials Science and Engineering, City University of Hong Kong
Total Approved Grant:	$499,640
Duration:	1/6/2021 to 30/11/2022
Project Status/Remarks:	Completed
Project Scope:	This project aims to develop a new technology for the efficient and delocalised generation of energy resources to achieve the cost-effective distributed renewable energy utilisation. In specific, the surface of large-size 3D porous micro-nanostructure (e.g., nickel foam, carbon cloth) is engineered to reach a dual function – (a). Solar-driven evaporation of seawater to freshwater; and (b). Solar-driven electrocatalytic hydrogen production from the pre-evaporated seawater, which can enable the large-scale deployment for eco-friendly and low-cost solar-driven hydrogen fuel production from local seawater as an alternative clean energy carrier. The implementation of this new technology can achieve the on-demand production of hydrogen fuels at the periphery of Hong Kong. This way, the hydrogen fuel can be generated in the local regions when it is needed, while there is no need to have a centralised generation as well as a large-scale storage and transportation of hydrogen fuels. All these development and demonstration can ultimately reduce the reliance of fossil energies in order to cut down the emission of carbon dioxide and other greenhouse gases in Hong Kong.
Summary of the Findings/Outcomes:	In this project, we developed a flexible surface modification technique on 3D porous micro-nanostructure to attain high-efficient catalysts for solar-driven hydrogen generation and seawater evaporation. Coupling these two techniques into a single standalone platform is promising to produce hydrogen fuel using sustainable solar resources and abundant seawater resources in Hong Kong, which is a cost-effective distributed renewable energy utilization. Moreover, since there is not any electricity grid system involved, the implementation of this new technology can achieve the delocalized generation of hydrogen fuels at the periphery of Hong Kong and the Greater Bay Area on a large scale.