Environmental Research, Technology Demonstration and Conference Project

ECF Project:	ECF 2022-08
Project Title:	Environment and Conservation Fund - Energy-Saving Passive Evaporative Eco-Cooling Paint
Principal Investigator:	Dr Zhou Simen, Department of Mechanical and Aerospace Engineering, The Hong Kong University of Science and Technology
Total Approved Grant:	$484,000 (ECF & WWGF: 50/50)
Duration:	1/4/2024 to 31/3/2026
Project Status/Remarks:	To be commenced
Project Scope:	In Hong Kong, air-conditioning systems for buildings currently consume approximately 30% of electricity, putting several million tons of carbon emissions into the atmosphere each year. The aim of this proposal is to mitigate the dependence on air-conditioning systems and reduce carbon emissions through the development of a novel green passive evaporative cooling technology (i.e., a metal-organic framework (MOF)-based paint). This new passive evaporative cooling technology does not require any electricity input and generates zero greenhouse gas emissions. This can be achieved without the need of exacerbating construction costs or equipment upgrades. The preliminary study of the project team shows that the MOF-801 paint can reduce the temperature of buildings by 3~10 ℃ via its passive adsorption-desorption process of atmospheric water. However, its poor durability strongly limits real-world applications. Here, the project team proposes to mix the synthesised MOFs (e.g., MOF-801 and MIL-101) with a binding agent (i.e., hydroxypropylmethylcellulose, HPMC) in a proper mass ratio to form versatile, scalable, waterproof, and durable MOF-based paint while only sacrificing a small amount of cooling efficiency. It is expected that buildings equipped with these products (e.g., the mass ratio between MOF and HPMC is 2:1) will reach 2~7.5 ℃ lower than the ambient temperature during the daytime.
Summary of the Findings/ Outcomes:	To be available upon completion of the project