Environmental Research, Technology Demonstration and Conference Project

ECF Project:	ECF 2020-107
Project Title:	Transparent wood for energy saving applications: Coated wood glass – From fabrication to technology demonstration
Principal Investigator:	Dr Nuruzzaman Noor (from 1/9/2021 to 21/8/2022) and Dr Fei Bin (with effect from 22/8/2022), Associate Professor, School of Fashion and Textiles, The Hong Kong Polytechnic University
Total Approved Grant:	$850,000
Duration:	1/9/2021 to 31/8/2023
Project Status/Remarks:	Completed
Project Scope:	This project aims to develop, investigate and output prototypes of functionally coated transparent wood substrates (e.g.; with coatings of ZnO, CuO, silica, etc.). Coated transparent woods are extremely thin, transparent, flexible co-polymeric membranes hosting a plasmonic layer with optical (and other functional) properties not present in natural materials. These novel composite materials have the potential to displace glazing and offer new and disruptive routes to sustainable building construction materials (e.g. glazing, roofing, etc.) for CO_2 mitigation and energy-use reduction. Reduced energy usage and greenhouse emissions as well as increased recyclability and energy efficiency of buildings in Hong Kong, is critical to meeting the 2050 zero-carbon international commitments. The project outputs will positively and directly contribute in a practical way towards environmental improvement and conservation, leading to increased recyclability, life-cycle extension and potentially closed-loop systems in dealing with one of the most energy-intensive industries on the planet: the construction and building materials industry.
Summary of the Findings/Outcomes:	Functional transparent woods have been created based on proper chemical treatment of natural wood, improved resin infiltration technique, and novel ultrasonic deposition approach of nanomaterials. During the project research, deposition parameters and precursor chemistries have been optimized to tune and manipulate the various transparency-optical discrimination properties. Additional radiative cooling, flame retardant, and photocatalytic self-cleaning properties have been realized on the transparent woods, via combination of versatile new materials and well controlled microstructures. This project improved the transparent woods into attractive candidates for building, automotive, solar panel, and wearables. Mass production efforts will be paid in next-stage research and development.