Abstract

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DEVELOPMENT OF A PHOTOVOLTAIC INTEGRATED INSULATED CONCRETE SANDWICH PANEL

Insulated concrete sandwich panels are composed of two concrete wythes separated by an insulation layer and connected by shear connectors. This paper develops a multifunctional photovoltaic (PV) integrated insulated concrete sandwich (PVICS) panel, which can act as a passive energy system through the insulation layer and an active energy system by harvesting the solar energy using attached thin-film solar cells. The panel features an innovative co-curing scheme, where solar cells, Fiber-Reinforced Polymer (FRP) shell, and polymer concrete are manufactured together to act as a formwork for the sandwich panel. The objective of this paper is to prove the concept of PVICS based on bending test, Finite Element (FE) analysis and analytical study. It can be concluded that the test results correlate well with those from the FE and analytical models. FRP shell can act as both shear connectors and reinforcement. The panel achieved 82% Degree of Composite Action, which can provide enough strength and stiffness. Solar cells worked properly under service load. Shear-lag effect was observed for the strains along the width of the panel.