The study of the arrangements of an opaque ventilated facades

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Abstract

In Thailand, a tropical country, the weather is hot and humid with temperatures reaching up to 40 °C in summer leading to an excessive heat from the sun which is a common issue causing high energy consumption from electronic devices. The use of opaque ventilated facade has been considerably increased especially in Europe because of its ability to enable smooth airflow, reducing turbulence and improve the heat transfer efficiency. The application of opaque ventilated facade in a tropical country is investigated in this science project. The aims of this study are 1) To simulate a 26.5 cm x 26.5 cm x 26.5 cm plaster house model with 1.9 cm thickness walls with a ratio of 3 water : 5 plaster. 2) To investigate an air cavity width between the model house's wall and the opaque ventilated facade covered in silica aerogel glue made by mixing a silica aerogel and a latex glue with a ratio of 3 : 5 that can reduce an excessive heat the best; the widths which had been studied were 0.5 cm, 1.0 cm, 1.5 cm and they were 0.6 cm high from a floor providing a gap for an air to flow in. 3) To compare a thermodynamics performance between a model house with each air cavity gap and a model house with no facade by using ANSYS program.

The results showed that 1) A 26.5 x 26.5 x 26.5 plaster house model with 1.9 cm thickness with a ratio of 3 water : 5 plaster can be made by using a plaster solution as an alternative glue. 2) An air cavity width of 0.5 cm has an ESR% (energy saving rate percentage) of 27.74%, an air cavity of 1.0 cm has an ESR% of 18.25%, and an air cavity of 1.5 cm has an ESR% of 15.33%. We can observe a decreasing ESR% between each air cavity; an air cavity of 0.5 cm gives off the best ESR% and an air cavity of 1.5 cm gives off the least ESR%. 3) An air cavity of 0.5 cm has the least turbulence in the channel allowing a colder air to replace a hotter air quickly, this resulted in a higher ESR% compared to other air cavity widths; 1.0 cm and 1.5 cm which have more turbulence in the channel disturbing a colder air to replace a hotter air making the ESR% becomes lower.

Keywords: Ventilated façade, Opaque façade, Heat transfer, Solar cooling effect