

## **Reducing room temperature by external insulated panels**

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### **ABSTRACT**

Heat transferred through the wall directly affects to the room temperature. There are several techniques that used to reduce the room temperature that is affected from outside temperature, i.g. double wall, internal insulator, external lath, and planting tree. Each method has its own advantages and drawbacks. Double wall technique use the air to be an insulator but the wall will thicker than the typical wall and produce more weight that applies to the structures. Internal insulator will affects to the reducing internal area or the room. Using external lath and tree will hide the external surface of the wall that will be used to present the building. This study aims to develop the external insulated panel and to investigate efficiency of developed panel in reducing room temperature. The developed external insulated panel consists of two main layer, i.e. Expanded polystyrene (EPS) and cementitious board. One side of EPS glues with cementitious board while other side glues with external surface of the wall. Experimental testing are set up for both the wall with and without external insulator panel. The temperature of inside and outside specimens are collected every two hours. The results show that using the developed panel can reduce the temperature effectively.

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### **1. INTRODUCTION**

Perimeter wall of building is typically exposed to direct sunlight. Outside and inside air temperature is interacted through the perimeter wall. In other words, outside temperature transferred through the perimeter wall directly affects to the room temperature. In Thailand, the outside air temperature typically higher than inside one. There are several techniques that used to reduce the room temperature that is affected from outside temperature, i.g. double wall, internal insulator, external lath, and planting

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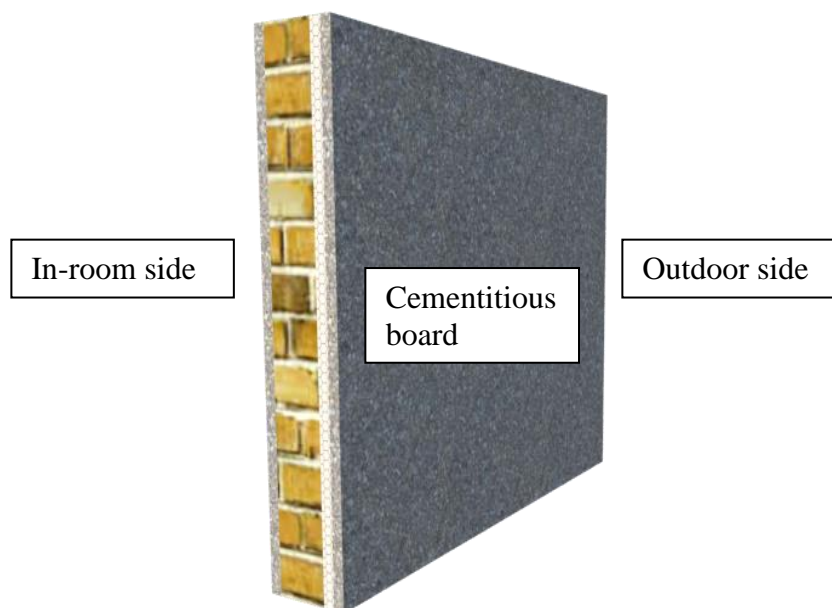
tree. Each method has its own advantages and drawbacks. Double wall technique use the air to be an insulator but the wall will thicker than the typical wall and produce more weight that applies to the structures. Internal insulator will affects to the reducing internal area or the room. Using external lath and tree will hide the external surface of the wall that will be used to present the building.

Thailand situated near equator. There is high temperature almost year. Therefore, using insulator in order to reduce effect of outside temperature on room temperature is interested to study (Morely (2000), Puvanant (2007), Puvanant (2008), Puvanant (2011), Su-angka et al. (2014), and Thangthong and Wethyavivorn (2011)). Sujisakulwong (2000) studies about the thermal performance of masonry constructions for hot humid climate. The results show that using external insulator is the most efficient method for controlling room temperature. However, Sujisakulwong uses only 3 inch-thick insulator in his study. ...

This study aims to develop external insulated panel and to investigate efficiency of developed panel in reducing room temperature. Key of development is external insulator that still presents solid appearance of masonry walls. Thickness of insulator is varied in order to investigate effects of their variation on room temperature.....

## 2. PROPOSED EXTERNAL INSULATOR PANEL

The developed external insulated panel consists of two main layer, i.e. expanded polystyrene (EPS) and cementitious board. One side of EPS glues with cementitious board while other side glues with external surface of the wall by structural glue. Details of developed panel is shown in Fig. 1

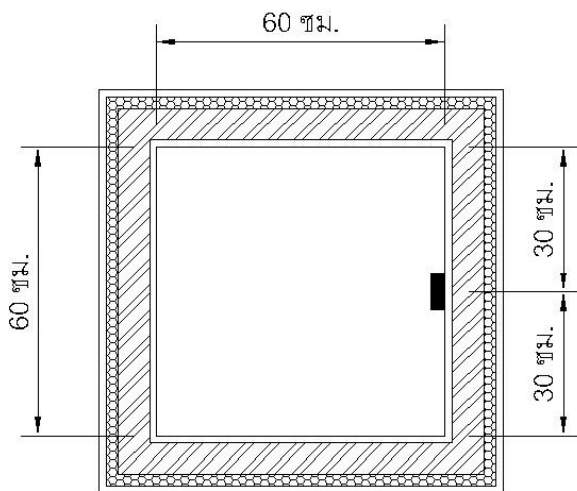


**Fig. 1** Details of developed external panel installed with masonry wall

The thickness of 1 lb/ft<sup>3</sup> density EPSs used in this study are 2.5, 5.0, and 7.5 centimeter. Thickness of cementitious board is 0.6 centimeter....

### 3. Experiments Setup

In order to investigate the efficiency of developed insulated panel, 4 boxes of masonry wall are built as shown in Fig. 2. Four boxes of specimen consist of one masonry wall without insulator and three masonry walls with 2.5, 5.0, and 7.5 cm-thick insulator, respectively. ...

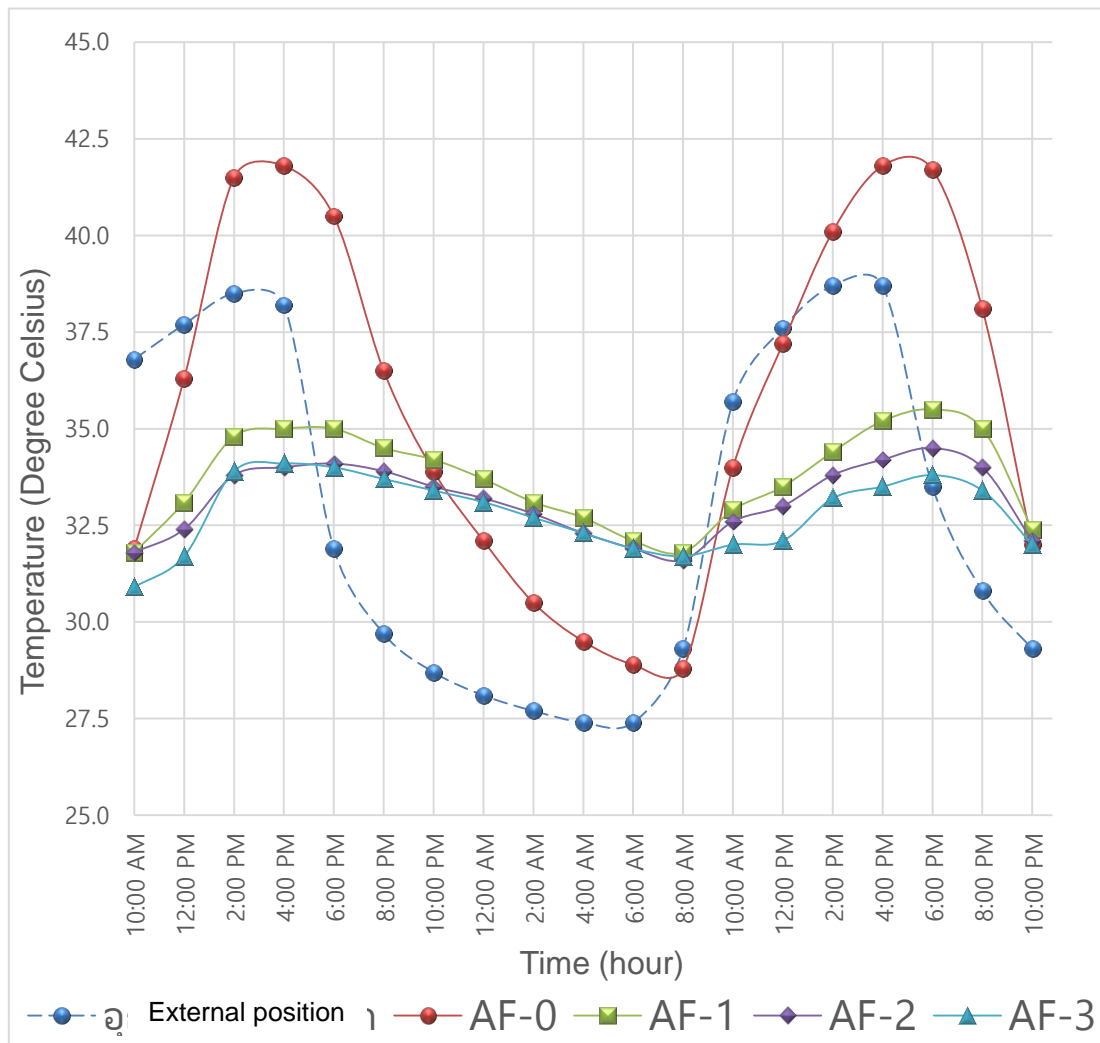


**Fig. 2** Details of masonry wall test specimen

Clear space of internal volume of specimen is 60 x 60 x 60 cm. Top and bottom of masonry boxes are closed by 7.5 cm-thick EPS. Digital thermometers are installed at four positions, i.e. external space, external surface of the wall, internal surface of the wall, and center of internal air volume through the top EPS cover.

### 4. RESULTS

Temperature of all specimens are collected every 2 hours interval during 36 hours consecutive. Results in form of internal temperature of all specimens are present in Fig. 3. The specimen without insulator is referred as AF-0. The specimens with 2.5, 5.0, 7.5 cm-thick insulator are referred as AF-1, AF-2, and AF-3, respectively.



**Fig. 2** Details of masonry wall test specimen

Results show that highest of inside temperature of the wall without insulator is about 38.5 degree Celsius while the lowest temperature is 27.4 degree Celsius. It is obviously shown that installing the developed external insulated panel can reduce the inside temperature about 3.5 degree Celsius. Moreover, installing the insulator make the inside temperature smooth all day. However, increasing thickness of insulator slightly decreases inside temperature.

## 5. CONCLUSIONS

This study aims to investigate efficiency of the developed external insulated panel through an experimental investigation. The results in form of the comparison of inside temperature are present and lead to the following conclusions.

The developed external insulated panel has an efficiency to be used to reduce the inside temperature of all test specimens. Increasing the thickness of insulator slightly increases the panel efficiency. The developed panel can be easily installed to the typical masonry walls by structural glue. External appearance of wall with developed panel remains solid look and can be finished by typical finishing procedure such as color painting.

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