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A New Energy-Efficient Building System Based on Insulated Concrete Perforated Brick with a Sandwich

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Abstract

The purpose of this research is to put forward a new energy-efficient building system that can meet the energy saving requirement of 65% for public buildings in cold areas based on modified insulated concrete perforated brick with a sandwich. Modified brick was composed of three parts and three parts can be made a whole in brick manufacturing and it was called self-thermal insulation concrete perforated brick and could avoid appearance of cracks. The test was done to obtain thickness of EPS for modified insulated concrete perforated brick with a sandwich in order to meet the requirement of insulation. Thickness of EPS was set to 45, 50, 55, 60, 65 and 75 mm respectively and comparative experiments were also carried out to verify the effect of insulation for modified bricks and unmodified bricks. Field tests were carried out to obtain appropriate masonry methods for modified bricks. Based on the results of analysis and discussion, then obtained: (1) Heat transfer coefficient of wall made by modified bricks was less than heat transfer coefficient of wall made by unmodified bricks when the same for thickness of EPS, it could be reduce by up to 45%; (2) When thickness of insulating layer was 65 mm, heat transfer coefficient of wall made by modified bricks could reached minimum limit 0.45 and it could meet energy saving requirement of 65% for buildings in cold area. (3) Insulating layer, located inside of the wall, could avoid appearance of cracks on surface of wall for modified bricks.

Keywords: Thermal Performance; Improved Brick; Heat Transfer Coefficient; Masonry Methods; Insulation Measures; Thermal Bridge.

1. Introduction

Living environment was very important for the development of humanity and society. In order to meet the comfort requirements of living environment, large amount of energy was consumed by buildings in winter and summer every year for the heat transfer through external walls. Because of the reduction of oil and coal resources, energy saving was urgent for all countries and regions. So it was very important to take measures to improve insulation performance of external wall in buildings.

External thermal insulation system (ETIS) was widely used in insulation of external wall in buildings in cold area. Insulation materials was pasted on surface of external walls of building in ETIS after main structure of building was completed. Good heat-insulation effect and thermal bridge not existed were the advantage for ETIS, so it was widely used in building. But there had been imperfections in ETIS, for example, cracks appeared on the surface of external walls over a long time and it caused rainwater to seep into ETIS, so cracks could reduce the quality of external walls and it made external walls instability [1]. The characteristic of poor fire resistance existed in ETIS also [2].

In view of the imperfections that existed in ETIS, self-thermal insulation system (STIS) was put forward. The STIS

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