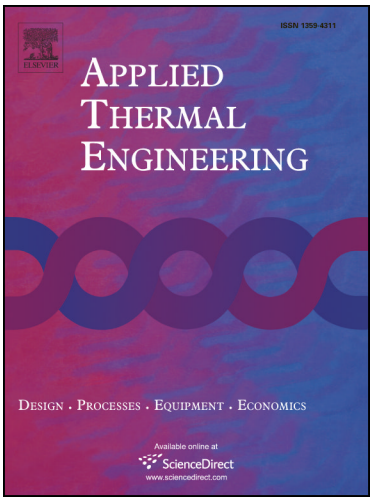

Research Paper

Thermal performance of building wall materials in villages and towns in hot summer and cold winter zone in China

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Thermal performance of building wall materials in villages and towns in hot summer and cold winter zone in China

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Abstract: Based on the current state of building wall materials of rural buildings in China consume large amounts of energy and have poor thermal performances, theoretical calculation and test detection of thermal performances were carried out for concrete block, cavity wall made of sintered Dalun brick, non-clay sintered porous brick wall, rectangular porous block construction, composite ceramic concrete block construction, steam-pressed sand concrete block masonry with gas, and concrete porous brick wall. And the experimental results of heat transfer coefficients were generally consistent with the theoretical calculations. Both test results and theoretical calculation results of the wall heat transfer coefficients are processed using the weighted average method. Among the above-mentioned walls, we found that the heat transfer coefficients for the rectangular porous block construction, composite ceramic concrete block construction and steam-pressed sand concrete block masonry with gas were 1.22W/m^2·K, 0.99W/m^2·K, and 0.97W/m^2·K. All of these materials met the standards such as *Design Standard for Energy Efficiency of Rural Residential Buildings*. These materials which met the standard were suitable for exterior walls of buildings and could meet the standard requirement of 50% energy saving. Gray theory analysis showed that the influencing factors such as coefficient of thermal conductivity of wall materials, wall thickness and mortar thickness had successively decreasing grey correlation degrees with the wall heat transfer coefficient.

Keywords: Hot summer and cold winter zone; Buildings in villages and towns; Wall materials; Thermal performance; Gray theory analysis

Introduction

With the progress of urbanization and the improvement of people's living standards in China, building energy consumption has been continuously increasing[1-3]. It is predicted that the building energy consumption will account for about 35% of the total energy consumption by 2020[4]. The data of national special inspection on construction energy conservation situation published by Ministry of Housing and Urban-Rural Development of the People's Republic of China show that although the number of new buildings has been increasing, the proportion of new buildings meeting the design standard for energy efficiency is lower[5]. In many places, great imbalances exist, where the proportion of new buildings meeting the design standard for energy efficiency in hot summer and cold winter conditions is less than 20%[6]. At the same time, the thermal insulation and air tightness of the building envelopes in villages and towns are poor, which leads to poor indoor thermal environment. Therefore, it is necessary to take certain measures to improve the capability of heat preservation and thermal insulation of the building envelopes. In recent years, there has been growing interest in analyzing the dynamic thermal characteristics of building envelopes to understand their thermal performance, optimal management and use of energy in

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