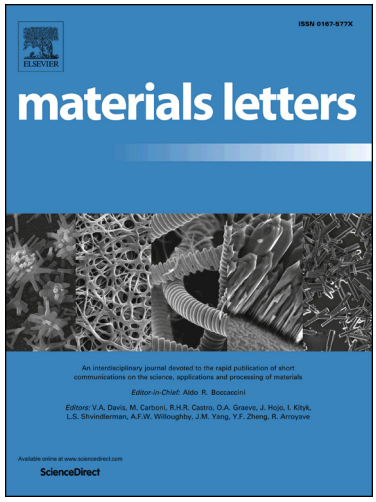

Thermal conductivity and mechanical properties of porous concrete materials

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Thermal conductivity and mechanical properties of porous concrete materials

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Abstract: The aim of this research is to examine the effect of the water-binder (W/B) ratio, replacement of cement by fly ash and incorporation of water-reducing agent on the thermal insulation and mechanical properties of porous concrete with a density of 600 kg/m^3. It was found that porous concrete achieved the optimum performance with a W/B ratio of 0.32, a fly ash replacement percentage of 30% and the addition of 0.65% of water-reducing agent. Under these optimal conditions, in the porous concrete specimen obtained the 28-day compressive strength up to 4.37 MPa, a 12% rate of water absorption and a heat conductivity coefficient of 0.116 W/(m·K). Overall, the findings show that the fabricated porous concrete (with a 150 mm thickness and a density of 600 kg/m^3) fulfills the requirements of ultimate capacity and thermal insulation of the insulation layer for accessible flat roofing. More attractive, the product is cost-effective and may be useful in a wide range of applications.

Keywords: Porous material; Mechanical properties; Thermal conductivity; Mix; Water-reducing agent

1 Introduction

About 46.7% of China's total energy consumption are associated with construction-related activities. Reducing the energy consumption of building projects is essential to effectively curtail the total social energy consumption and improve people's livelihoods[1,2]. As parts of the retaining structures, roof insulating materials are required to perform the functions of thermal insulation while bearing live loads. They are the main section of building energy-saving engineering. However, the existing structures of the extension insulation boards suffer from several limitations, such as a high cost, low bearing capacity, long construction period, as well as being prone to leakage or other quality problems [3-6]. Attempts have been made to overcome these deficiencies. As a result, interests in developing new roof insulating materials have sparked intensive and extensive research in this areas. The current study was conducted in search for such new and appealing insulating materials.

This paper investigated the thermal conductivity and mechanical properties of porous concrete materials (with a density of 600 kg/m^3) prepared with different water/cement ratios and addition of different amounts of fly ash (Fa) and water-reducing agent (Wra). Hopefully, the findings from this study will provide the theoretical basis for replacing the existing roof insulation materials and broadening their corresponding application.

2 Mix proportions and properties of porous concrete