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URBAN ENERGY SAVING AND CARBON REDUCTION POTENTIAL OF NEW-TYPES OF BUILDING MATERIALS BY RECYCLING COAL MINING WASTES

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Abstract

The construction industry is one of the main sectors of energy consumption and carbon emissions in China. The new-types of building materials can be produced by recycling industrial solid wastes which is an effective solution to development of green building materials and abatement of environmental emissions. In this paper, new-types of bricks made of fly ash (residues generated in coal combustion) and coal gangue (a kind of solid wastes generated in coal mining and coal production) and the conventional types of bricks (refer to perforated clay bricks and clay bricks here) are taken as examples to analyze their differences of embodied energy and carbon emissions. The energy saving and reduction of carbon emissions of different types of bricks are estimated in brick production phases and in construction phases of buildings.

In phases of brick production, the embodied energy of new-types of bricks is lower than that of conventional types of bricks. The carbon emissions of fly ash brick is between perforated clay brick and clay brick while the carbon emissions of coal gangue brick is higher than that of both conventional types of bricks. The coal gangue brick and fly ash brick have better advantages of energy saving in brick production phases while the reduction of carbon emissions of both new-types of bricks is not statistically significant compared with that of conventional types of bricks.

In phases of building construction, the fly ash brick has no advantages of both energy saving and reduction of carbon emissions compared with the conventional types of bricks while coal gangue brick has advantages of energy saving but having no advantage of reduction in carbon emissions. In addition, the differences of embodied energy and carbon emissions of residential buildings using new-types of bricks and conventional types of bricks are analyzed. The results showed that new-types of bricks from coal gangue can improve the energy efficiency and increase the carbon emissions of residential buildings in their building production phase compared with conventional type of bricks while fly ash bricks had no statistically significant difference with conventional types of bricks. Our research indicates that production of new-type green building materials by recycling industrial solid wastes from coal mining and coal combustion is an alternative way to realize energy-saving for sustainable construction industry in China.

Key words: embodied energy, industrial solid wastes, urban carbon emissions, wastes - recycling based building materials

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