ENERGY-EFFICIENT MAINTAINING OF THERMAL COMFORT IN BUILDINGS BY THERMO-ACTIVE ALUMINIUM FOAM ROOFING

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Abstract

Thermal comfort in buildings is usually provided through the heat exchangers requiring a relatively high temperature gradient that is most often obtained by conversion from electricity or combustion of coal, gas, resp. biomass. The development is therefore focused on active systems for solar heating in combination with suitable containers for heat storage and distribution systems in order to use emission-free alternative energy for heating of buildings and domestic hot water. The interior cooling during hot summer days is usually solved independently and is ensured almost exclusively by electrically powered air-conditioning or air-recuperative units. Prospective environmentally attractive solution ensuring the thermal comfort of buildings is the effective use of rarely used heat from a low-temperature difference (15°C), which can be obtained every day from the difference between day and night temperatures without any need for heating/cooling using electric power or combustion of fossil fuels.

The focus of this R&D study is based on describing performance of novel large-scale aluminium foam roofing with integrated function of heat exchanger which is able effectively to obtain low potential heat from the surroundings of building and transfer it through the liquid heat transfer fluid to the interior of the building. The roof cladding made according to this concept is simultaneously able to dissipate excess heat accumulated in the building to its surroundings during hot summer nights when the outside temperature drops below 20°C.

Various technical solutions of surface coating are described in this contribution to explain the appropriateness of most beneficial methods for application of suitable coatings to the surfaces of the aluminium foam castings that lead to obtaining useful characteristics for the optimal interaction with the rain water and water vapour, ensuring colour stability when exposed to sunlight, frost resistance up to a temperature – 15°C, heat resistance up to 60°C, and the ability to achieve efficient heat transfer between the external environment and internal structure of the foam through roofing surface.

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Keywords

aluminium foam, heat exchangers, solar radiation, heat storage, energy efficiency

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