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Thermal performance of a concrete-metamaterial added with micro-sized carbon particles for thermal insulation purposes

Juan Carlos Arteaga-Arcos, Monroy Hernandez M, Mayorga M and Romero Salazar L
Universidad Autonoma del Estado de Mexico, Mexico

Buildings and houses are designed to provide comfortable environments to human beings; in extreme climates, this comfort is strongly related to the thermal performance in closed rooms which can be controlled either by mechanical heating, or air-conditioning systems as needed. All these systems are associated with energy consumption. Thermal insulation is one of the most feasible strategies used worldwide in order to achieve improved energy efficiency and specific comfort levels, especially in buildings and dwellings; these kinds of buildings are responsible of the consumption of about 49% of primary energy and the emission of approximately 57% of the greenhouse gases into the USA territory. In China, the percentage of energy spent by dwellings ranges 25-40% of the total consumption of the country. A metamaterial can be defined as a tailoring designed engineering material not found in nature with specific performance. In this research work, we present the thermal characterization of a concrete-metamaterial modified with carbon micro-sized particles in order to control the thermal performance of concrete plates. We replaced cement by carbon at different percentages (10%, 15% and 20%), were a nonlinear behavior of the thermal performance was observed. The results presented herein are intended for increasing the efficiency of heat transportation into the concrete for thermal insulation purposes.

Biography

Juan Carlos Arteaga-Arcos is a Civil Engineer and got his PhD with major in Material Sciences in 2010. Since February 2011, he is an Assistant Professor at the Autonomous University of the State of Mexico in the School of Sciences. His expertise areas and interests are regarding cementitious and ceramic materials and topics related to sustainability, energy savings, optimization of process, reutilization of industrial by-products, biomaterials, and rheology behavior of fluids. He is member of the CONACyT-National Research System in México.

jcarteaga_mx@yahoo.com.mx

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