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Thermochromic cement-based envelopes as dynamic cool materials for buildings' energy efficiency

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This paper reports a selection of results achieved in the framework of the Italian funded project "COOL-IT". The study evaluates thermal/optical characteristics of experimental cement-based thermochromic envelopes for buildings energy efficiency applications. In Europe, 50% of the energy consumption of the building sector, and related GHG emissions, concerns heating and cooling systems consumptions, with cooling energy demand expected to rise significatively by 2050. The design and use of selected cool concrete building envelopes for future sustainable cities can contribute to decrease buildings energy loads - mainteining indoor thermal comfort too-as well as to mitigate urban heat island phenomenon. Within this context, the use of thermochromic cementitious materials for buildings energy saving has been investigated. Experiments with cement-based coatings and mortars have been performed, incorporating microincapsulated thermochromic pigments (commercially available) of organic nature having a selected transition temperature of 31°C. At lower temperatures, the thermocromic products appear grey (Dark Phase) while, when exposed to higher temperatures, they enhance their solar reflectance becoming whiter (White Phase). Higher values of total solar reflectance result in lower surface temperatures, thus building cooling loads and urban overheating are decreased too. An accelaretd test method has been set up to evaluate aging of thermochromic coatings. The results show a good compatibility of some selected pigments with cementitious matrix and their poor stability over time (few hours), due to phtodegradation under UV and VIS radiations.

Biography

Andrea Cacciatore is a Senior Researcher in GPI (Global Product Innovation)-Italcementi SpA, where he has been working since 2007. He has completed his MSc in Materials Engineering from Università del Salento studying hydrothermal and mechanochemical synthesis of titania-graphitic composites materials. His R&D work focuses on smart materials for building applications, taking into account in particular photocatalytic, cool, and Graphitic Related Materials. Since 2007 he has been involved in the concrete applications of dynamic and static cool materials in the freamwork of the Italian founded Project COOL IT.

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