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THERMAL PERFORMANCES OF CERAMIC GLAZES CONTAINING ZIRCON

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One of the solutions to lessen the urban heat island effect is the use of external flooring materials and components for the building envelope that have high radiative properties; so-called cool materials. Materials used for cool roof construction include spray paints and sheaths, waterproof membranes and polymer bitumens. These materials are, however, affected by the deposition of dirt and degradation so require periodic washing, maintenance or restoration treatments. To reduce the level of maintenance it would be advantageous to use materials with high durability physical-chemical characteristics, such as ceramic tiles.
The addition of zircon in ceramic glazes, to increase solar reflectance, can be a way to improve the potential of ceramic tiles as a cool building material. An added value compared to the existing cool materials is the fact that ceramic glazes are characterized by greater durability and, with a view to reduce building maintenance costs, ceramic glazes can be designed with a surface finish to increase the tiles' cleaning performance.
The present novel study was carried out to evaluate the effect of zircon additions to ceramic glazes of various colours. Zircon was added both as an opacifier inserted directly into the glaze formulation, and as frit component. The solar reflectance index (SRI) was calculated on all glaze samples and the CIELab L *, a *, b * colorimetric coordinates were also determined, to evaluate any colour variation due to the presence of zircon. The thermal performances of the samples were then studied whilst exposed in the outdoor environment during the hot summer period.
Results of tests carried out on samples of glazed ceramic tiles show that, in general, the addition of zircon increases the solar reflectance index (SRI) of the glazes, the effect being more pronounced when zircon is added as an opacifier. Also, as the zircon percentage in the glaze increases the SRI value increases linearly for all the colours analysed, especially in yellow glazes (SRI increased 24.6% from 69 to 86 with a 10wt% zircon addition as opacifier). Monitoring of the surface temperatures of the tile samples when exposed outdoors to solar radiation confirms that the higher values of brightness and solar reflectance parameters of the glaze are associated entirely to the addition of zircon.
Excluding the colour appearance, the improvement in terms of reduced surface temperature is observed in the glazed samples with higher spectral curves in the NIR range, in particular after 1500 nm. The increase in spectral values in this range is an effect that can be related to the addition of zircon in the glazes.
In conclusion, this novel study shows that zircon additions can increase the cool effect in the composition of glazes for ceramic tiles. Such tiles, if used as a building envelope, are able could improve the thermal comfort in the home by reducing energy requirements and, compared to existing solutions on the market, are able to reduce maintenance costs due to their very high resistance to wear, dirt and staining.

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