Study of near-infrared reflective performance of metal oxide nanomaterials for building's external walls coatings

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INTRODUCTION

The growing concern about energy issues in buildings related to cooling needs has led to the search for new constructive solutions[1]. Progressively, such constructive solutions require darker colors, so the incorporation of nanomaterials might be a possible solution. The excellent optical properties turn metal oxide nanomaterials into excellent candidates for use in coatings with high solar reflectance with dark tones without affecting the aesthetic characteristics, thus improving the durability of the coatings[2]. By tunning the optical properties of nanomaterials in a specific wavelength, it is possible to reduce the energy absorbed by the surface where the reflective coating is applied, for instance, in pavements, roofs and walls[3].

EXPERIMENTAL/THEORETICAL STUDY

Our main goal is to improve the reflectance of commercial black colorants used in finishing coatings for building components by doping with metal oxide nanomaterials that present NIR reflectance. The reflectance and colorimetric properties were assessed using a portable modular spectrophotometer. The effect of size, bang gap energy and concentration (from 1% to 20%) of different nanoparticles (e.g., ZnO, TiO_2, CuO) dispersed in the black colorant were studied to understand and correlated their behavior with intrinsic properties.

RESULTS AND DISCUSSION

All the samples doped with nanoparticles revealed an increase in the NIR and total reflectance (Fig.1. a). Also, the perceptual lightness (Fig.1. b) presented lower values compared with the conventional samples, which became lighter.

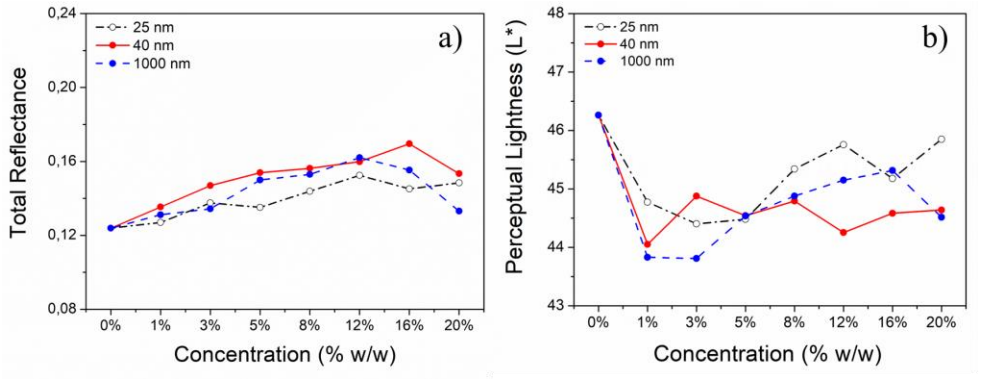

Fig.1: Average total reflectance (a) and perceptual lightness (b) of the TiO_2-doped black colorant.

CONCLUSION

The use of the different nanoparticles leads to an important improvement in the total reflectance of the samples. These achievements can lead to the development of innovative envelope systems with increased solar reflectance through new formulations containing metal oxide nanomaterials, thus leading to potential energy savings and thermal comfort.

REFERENCES

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