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Optical properties of Protectam FN® functional coatings

Introduction

Protectam FN® functional coatings (FN) are based on nanocrystalline-TiO_2 semiconductor, which act as a photocatalyst. When it is illuminated with light of energy higher than the bandgap, an inter-band transition can be induced and electron-hole pairs are generated. Thus, the TiO_2 surface converts into a strong oxidizer that clean polluted air and protect the surfaces against fading.

Materials and Methods

The optical properties, transmittance and reflectance, of the Protectam FN® functional coatings deposited on quartz in three layers were measured with the Perkin Elmer Lambda 950 UV-VIS-NIR spectrometer equipped with spectralon and gold integration spheres for diffuse reflectance measurements in the UV-NIR region.

Results and Discussion

The transmittance spectra of Protectam FN®, is plotted in Fig. 1, as well as the transmittance of quartz glass, which was used as a reference. The transparency of the layers in a large wavelength domain from 800 to 400 nm. The spectra exhibited a high visible transmittance, up to 60 % in the visible range with a sharp absorption edge at ~400 nm. TiO_2 incorporated in the coatings matrix appears transparent whilst still providing UV light absorption.

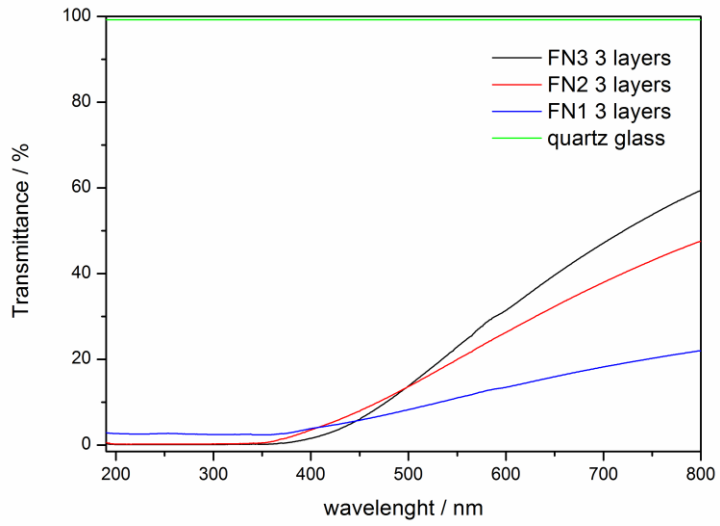

Fig. 1: Transmittance spectra of Protectam FN® coated on quartz glass.

In comparison with Degussa P25, the diffuse reflectance spectra of the Protectam FN® coatings showed a significant red shift in the absorbance, which could be attributed to narrowing the band gap (Fig. 2). This effect provides some evidence of interactions between the binders and TiO_2, and also suggests that electron-hole pairs can be generated upon irradiation with longer wavelength-visible light. Consequently, these coatings are expected to show higher photocatalytic activity in the visible region of the spectrum.

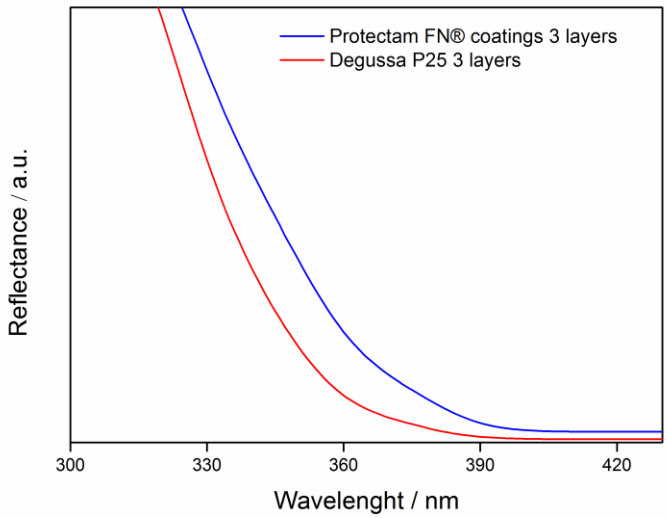

Fig. 2: Diffuse reflectance spectra of Degussa P25 (red) and Protectam FN® coatings (blue).

Moreover, when TiO_2 incorporated in a coating, it minimizes degradation of the system, e.g. embrittlement, fading and cracking, because of ultraviolet light absorption. This effect ensures the longevity of the functional FN coatings and the continued protection of the substrate. The use of light colored paints for interior applications provides an impression of openness and "space". In addition, the high "luminosity" that comes from light colored paints reduces the energy needed to light the interior of buildings when compared to darker colors. On the other hand, in exterior applications the coolness conferred by Protectam FN® colored surfaces leads to considerable energy savings by light reflectance thus reducing the need for air-conditioning.

Conclusion

For application purposes, the three-deposited layers protect the substrate against UV radiation and its gradual aging (see Results and Discussion section above).

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