POWDER COATINGS: A STUDY OF PROPERTIES BY ADDITION OF NANORESINS.

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Since the past decade until nowadays the interest in the powder coating development has been growing due to some characteristics that make this kind of paint an important alternative to traditional liquid paints.

A powder coating [1] consists in finely ground plastic particles formed from resin, crosslinker (in thermoset powders), pigments and extenders and various flow additives and fillers to achieve specifics properties. When the applied powder is heated, melt to form a continuous film; typically very durable and resistant films. One of most interesting characteristics of powder coating is that they are applied as a dry film, i.e., they contain very little, if any, Volatile Organic Compounds (VOC), so the raw material is literally a powder, mixed, dry extruded and ground into the final material. Then thermoset powder coatings are applied on the substrate by electrostatic or triboelectric spray application and cured by heat.

In this work, the changes of several optical and mechanics properties when we add different percentages of nanoresin to the paint formula have been studied and will be discussed. Nanoresin employed has been silica reinforced solid low molecular weight (type 2.5) epoxy resin. The silica phase consists of surface modified SiO2 nanospheres —average diameter of 20 nm— with a narrow particle size distribution with maximum diameter of 50 nm. Despite the high SiO_2 content (see Table 1), this nanoresin has a low melt viscosity due to the agglomerate-free colloidal dispersion of nanoparticles in the resin.

As nanoresin used is an epoxidic type of resin, we formulated a standard epoxy-polyester hybrid powder coating (50/50) to compare the results obtained with and without nanoresin; the standard epoxy resin employed has the same chemical properties than epoxy nanoresin.

In order to investigate certain optical properties, reflectance and colour measurements [2] were carried out by means of Perkin Elmer Lambda 800 UV-VIS spectrophotometer; and gloss measurements at 20º, 60º and 85º [3]. The mechanical properties evaluated were the flexibility and adhesion [4], [5] and impact resistance [6].

References:

[1] Powder Coater's Manual: http://www.coatings.de/pcmanual/pcmanual.cfm
[2] Commission Interationale de l'Eclaire (CIE), Colorimetry, CIE 15:2004, 3rd edition.
[3] Paints and varnishes: Determination of specular gloss of non metallic paint films at 20 degrees, 60 degrees and 85 degrees, ISO 2813:1994.
[4] Paints and varnishes: Bend test (conical mandrel), ISO 6860:2006.
[5] Paints and varnishes: Cross-cut test, ISO 2409:2007.
[6] Paints and varnishes:Rapid-deformation (impact resistance) tests. Part 1: Falling-weight test, large-area indenter, ISO 6272-1:2002.

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Figures:

TABLE 1. Main properties of nanoresin employed in the study.

Property	**Units**	**Typical values**
Base resin		Low molecular weight “type-2,5”epoxy resin
Appearance		Yellowish flakes
SiO2 – content	[wt%]	32
Melt viscosity @150 ºC	[Pas]	50
Softening point	[ºC]	93
Epoxy equivalent weight	[g/eq]	1050