NATURAL HYBRIDS NANOPIGMENTS SYNTHESIS FOR MULTIPLE INDUSTRIAL APPLICATIONS

DESCRIPTION OF THE TECHNOLOGY

The *Colour and Vision Research Group* has developed an optimised process to obtain hybrid nanopigments (with synthetic or natural dyes). This process could be transferred to improve optical, thermal and mechanical properties to the materials in which the nanostructured hybrid pigments are applied on.

Depending on the material properties to be reinforced, the nanoclay structures, the surface additives/modifiers, and their incorporation moment during the synthesis process are selected.

The nanopigment synthesis process needs the inorganic component (nanoclay) modification in order to allow and improve the dye interaction, and then, the polymer matrix interactions. To this end, surfactants, mordants or coupling agents were selected.

For the nanopigment synthesis and the nanocomposite generation, the following components were chosen: *(i)* nanoclays, *(ii)* dyes, *(iii)* thermostable polymers (resins), and *(iv)* thermoplastic polymers.

With this new procedure, added value is provided to the modified matrix and to the selected dyes, maximizing: the adsorbed dye in the nanoclay, the dye temperature fastness (degradation temperature), the polymer matrix temperature resistance (degradation temperature), the nanopigments colouring power, applied on a polymer matrix, and the UV-Vis colour fastness using nanoclays as host in the hybrid pigments.

Moreover, the following properties are improved: *(i)* the polymer matrix properties (flexural/tensile resistance, viscosity of the initial matrix, and the water barrier properties); *(ii)* the polymer flame retardant properties; and *(iii)* the coloured biopolymer transparency properties. Also, this method minimizes or avoids the dye migration effects on their application, both in wet or dry conditions.

Finally, it could be obtained a wide colour gamut from the same dye molecule, changing the synthesis process conditions. It also can be obtained different texture properties, depending on the nanopigment synthesis factors.

MARKET APPLICATION SECTORS

This kind of nanostructured hybrid pigments, within the of synthesis of materials, are able to provide improved optical, thermal, and mechanical properties to the materials in which it could be applied on, among others: ceramics, printing inks, paints, synthetic fibers, natural fibers, coating, textiles, paper, polymeric materials, biopolymers, cement and concrete, mortar, construction materials, cosmetics, food packaging, footwear, toys, wood and furniture, stone and marble, etc.

TECHNICAL ADVANTAGES AND BUSINESS BENEFITS

The developed method for synthesizing nanostructured hybrid nanopigments allows:

- Reducing the additives incorporated in the composite generation.
- Reducing the manufacturing composite cost.
- Maximizing the adsorbed organic dye (natural or synthetic) by nanoclays.
- Increasing the degradation temperature of both the organic dyes and the polymer matrix.
- Improving the final material mechanical properties.
- Adjusting the transparency and colouring power of the synthetized material.
- Increasing the degradation by UV-Vis light fastness of the coloured materials.

Moreover, it avoids the migration dye from the composites materials, by wet or dye friction.

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CURRENT STATE OF DEVELOPMENT

The technology has been developed on a pilot scale.

It has been done different characterization tests in order to evaluate the process of the synthesis performance, the reinforcement produced by the dye-clay interactions, the mechanical, optical and thermal properties of the materials in which they were applied the nanopigments. It has been used natural components in the nanopigment synthesis, and in the matrix materials, or binders.

INTELLECTUAL PROPERTY RIGHTS

This technology is protected through **Spanish patent**:

- *Title: "Procedimiento para la optimización de la síntesis de nanopigmentos híbridos".*
- *Application number: P201531534. Application date: 27th October, 2015.*

COLABORATION SOUGHT

Companies interested in acquiring this technology for commercial exploitation are sought. For example, through:

- License agreement or technology/know-how transfer agreements.
- Search of funding opportunities to new application developments, depending on the specific company requirements.
- Technical reports and scientific assessment.
- Customized training according to the company's requirements.

RELATED IMAGES

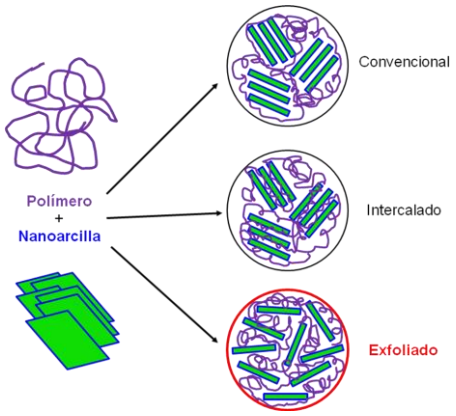

Image 1: *Example of structures of materials composed of inorganic nanoparticles and polymeric matrices*

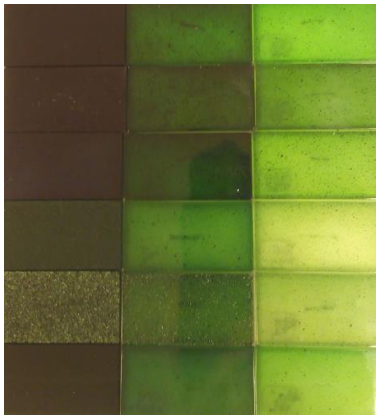

Image 2: *Nanopigments obtained from natural dye chlorophyll*

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