Different **dimension** of perfection

NANO TiO_2

NANO titanium dioxide

LONG-LASTING WOOD PROTECTION

UV ABSORBER

CINKARNA

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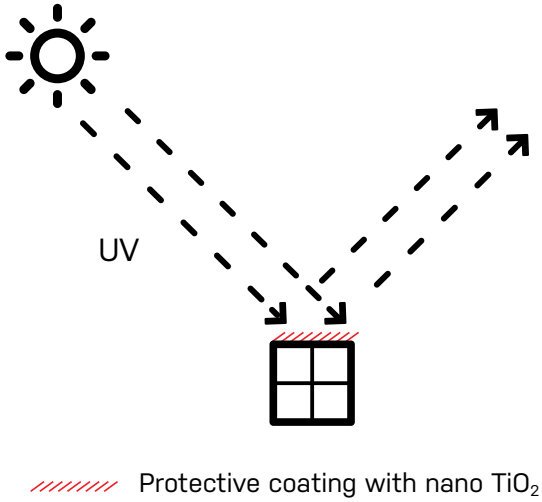
NANO TITANIUM DIOXIDE AND UV PROTECTION

Titanium dioxide is one of the most widely used inorganic materials in the world. The most common form is pigmentary titanium dioxide, but in recent years there has been a growing demand for nano titanium dioxide. Turning to smaller particles, i.e., creating nano sized titanium dioxide particles offers new properties and advantages to final materials that they are incorporated in, for example, such as UV protection of wood (UV absorber).

NANO TITANIUM DIOXIDE AS AN UV ABSORBER

When compared to anatase (photocatalytic property), rutile crystal structure of nano TiO_2 offers distinctive properties. Most known property of nano TiO_2 rutile is its resistance against UV radiation. Primary rutile nano TiO_2 particles which are not surface coated and notdoped still show photocatalytic activity under UV light. Doping and surface coating are processes, which provide the inhibition of the photocatalytic activity and achieve higher light absorbtion of nano TiO_2 - becoming excellent UV absorbers. As such, thanks to their transparency and high UV light absorbtion, the nano TiO_2 rutile particles incorporated into wood coating ensure UV protection and longer life span for wooden products.

UV PROTECTION - HOW DOES IT WORK?



By applying the coating with rutile nano TiO_2 incorporated in, we achieve a UV protection of the layer on the wood. When coating with UV absorber is exposed to UV light, nano particles prevent the UV light from penetrating through the coating to the wood surface. UV light is reflected and absorbed by particles, therefore the wood is protected from harmful UV radiation. This way natural look of the wood is preserved without changing its colour.

ADVANTAGES

- Long-lasting wood protection
- UV protection in the full UVA and UVB range (up to 400 nm)
- Aqueous suspension with a neutral pH
- Preserves the natural colour of the wood

OUR NANO TiO_2 PRODUCTS FOR WOOD PROTECTION

PRODUCT	USE	APPLICATION
CCR 150	Great UV protection and weather resistance.	Water-based wood lazures
CCR 220 Mn	Improved UV protection and weather resistance.	Water-based wood lazures

DID YOU KNOW?

Compared to a coating with organic UV absorbers, a coating with nano TiO_2 guarantees better UV protection performance, which doesn't decrease, as the TiO_2 particles don't disintegrate over time.

OUR SPECIFIC APPROACH TO MANUFACTURING

The elementary principle of our nano TiO_2 is the sulphate synthesis process, which is upgraded for the synthesis of final nano product. In Cinkarna Celje we decided to be strategically oriented towards the production of nano TiO_2 only in the form of a **water suspension**. We have already developed the synthesis methods for anatase and rutile nano particles that we obtain in the form of a suspension without any intermediate powder phase.

Advantages of our manufacturing process enable us to efficiently adapt to the customer's specific needs and provide them with high-quality products. The most important advantage and the difference in the manufacturing process is that we produce materials in the form of stable water suspensions.

Numerous manufacturers of nano TiO_2 material produce it by making a powder first and then grinding it into nano particles. In this case, they produce the powder form of nano TiO_2 materials, which is afterwards suspended in water. In our production, all process phases take place in an aqueous medium which guarantees better stability and dispersibility for our products without the presence of dry powdery material. In this way, we prevent the possible negative impacts that nanopowder causes if it comes into direct contact with people and the environment.

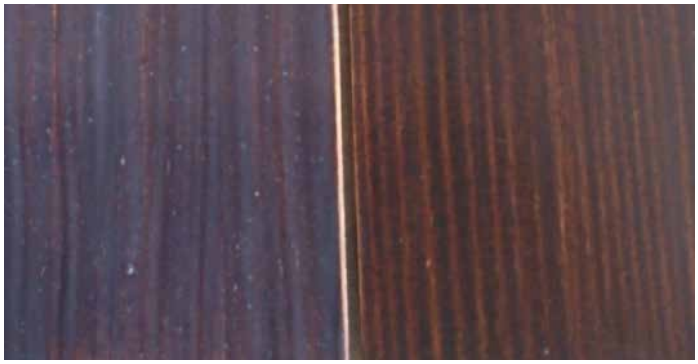
MIXING THE CCR UV ABSORBER INTO WATER-BASED WOOD COATINGS

Adding the CCR UV absorber helps us achieve good UV absorption properties and the coating transparency; however, the dispersion of the contained particles needs to be ensured. The dispersion of particles is achieved by correctly including the CCR suspensions. In this manner we avoid the agglomeration of particles and, as a result, poorer absorption and reduced transparency are avoided.

The recommended addition of the CCR active component into the coating is from 0.6% to 1%, calculated for TiO_2, in wet film with a thickness of 200 microns. By increasing the content of the active component, the UV light absorption level improves and thus the protection of the material from UV radiation increases; however, an overdose may cause reduced coating transparency.

After adding the CCR, it is recommended to intensely mix the coating in order for the particles to uniformly disperse in the coating..

It is recommended that the addition of water as a solvent should be increased to the maximum level at which the coating still remains stable and that is allowed by the system. It is also recommended that the binder is added last, even after the CCR.



If the dispersion of particles in the coating is not achieved (left picture of a board), the particles agglomerate and the coating becomes non-transparent and its light absorption quality diminishes. Once the conditions for a good dispersion of particles (homogeneous coating) and coating stability are met, the coating containing the CCR is transparent (right picture of a board) and has good absorption qualities.

CCR 150	CCR 220 Mn

Both materials are stabilized aqueous suspension of nano Titanium dioxide (TiO2) with excellent UV absorption properties. Our applied proprietary particle design and coatings technology is the basis for premium product performance in a wide range of applications where UV protection is required.

Designed and optimized for the use as high efficient UV absorber:

- Nano TiO_2 without pigmentary properties.
- Rutile crystal structure.
- Functionalized surface through inorganic coatings.
- Excellent UV absorber, with high transparency.

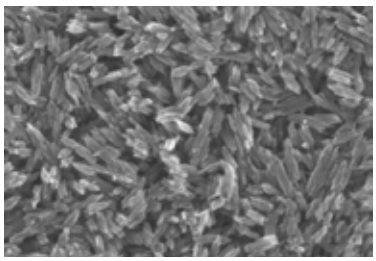
• Highly stabilized, neutral pH, slightly brownish aqueous suspension.	• Highly stabilized, neutral pH, skin color aqueous suspension. • Crystal lattice doped with Mn.

Main applications are:

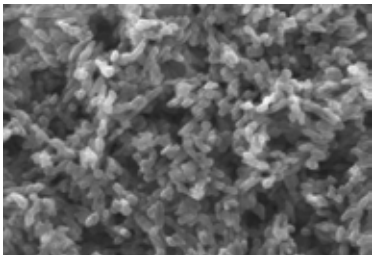
- Transparent coatings providing long term UV screening for various substrates.
- UV protection.
- Long-lasting wood protection

TiO_2 content	15 - 17 %
Density	~ 1.1 g/cm³
pH	6 - 8
Crystallite size (Scherrer)	~ 10 nm
Specific Conductivity	< 1 mS/cm
Surface treatment	Al_2O_3 , Fe_2O_3
Specific surface area	~ 140 m²/g

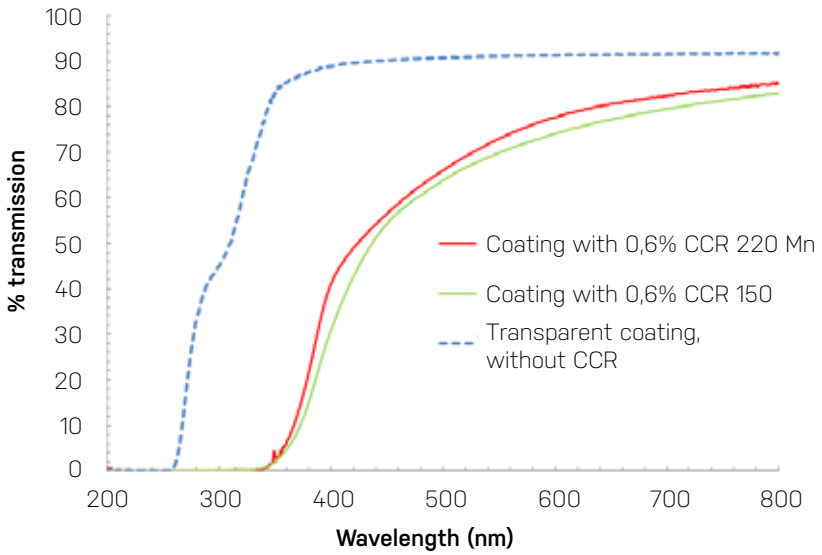
TiO_2 content	15 - 17 %
Density	~ 1.1 g/cm³
pH	6 - 8
Crystallite size (Scherrer)	~ 30 nm
Specific Conductivity	< 1 mS/cm
Surface treatment	Al_2O_3
Specific surface area	~ 70 m²/g



SEM image of the CCR 150



SEM image of the CCR 220 Mn



The effect of CCR addition into the coating. The addition of CCR improves the level of UV absorption in comparison with the basic coating without a UV absorber. By increasing the CCR content, the UV light absorption level is additionally increased.

THE FUTURE ...

Nano TiO_2 has an enormous potential for the future and represents a great advantage for people and the environment. Its scope of application extends into the fields of medicine, textile industry, energetics, automotive industry, electronics, etc.

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