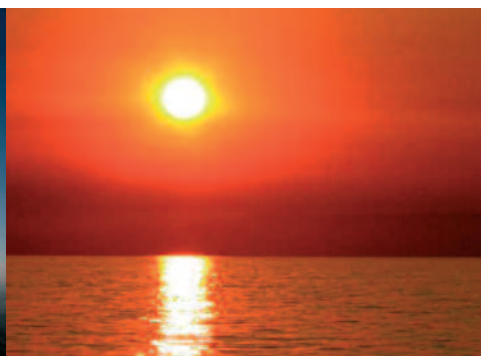


Application of photocatalytic titanium dioxide in various areas



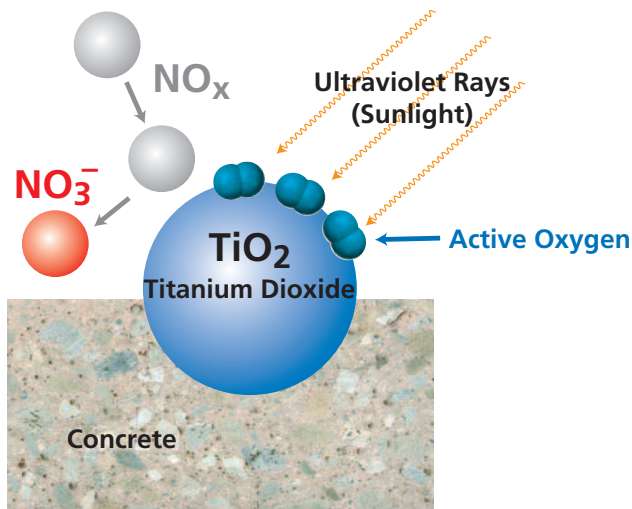
PRETIOX



BASIC PRINCIPLES OF PHOTOCATALYSIS OF TITANIUM DIOXIDE

Titanium dioxide acts as a very effective inorganic photocatalyst for removing some organic and inorganic pollutants (above all NO_x). When irradiated with the light of a wave length of 360 – 380 nm, electron-hole pairs are generated in valence and conduction bands. The following reaction in presence of molecules of water or oxygen results in creating surface radicals. They attack molecules of pollutants and cause their degradation by this way.

For example, if we irradiate concrete or a plaster mixture with photoactive titanium dioxide by UV light, NO_x is oxidized to nitric acid. This acid reacts with present calcium carbonate to calcium nitrate which can be washed with water into soil and can be used by plants, while liberated water and carbon dioxide remain in atmosphere.



The EU 1999/30/ES directive requiring a significant reduction of nitrogen oxide in all EU member countries not later than from January 2010 is the impulse for applying photocatalysts in building materials.

THE INDUSTRY OF BUILDING MATERIALS

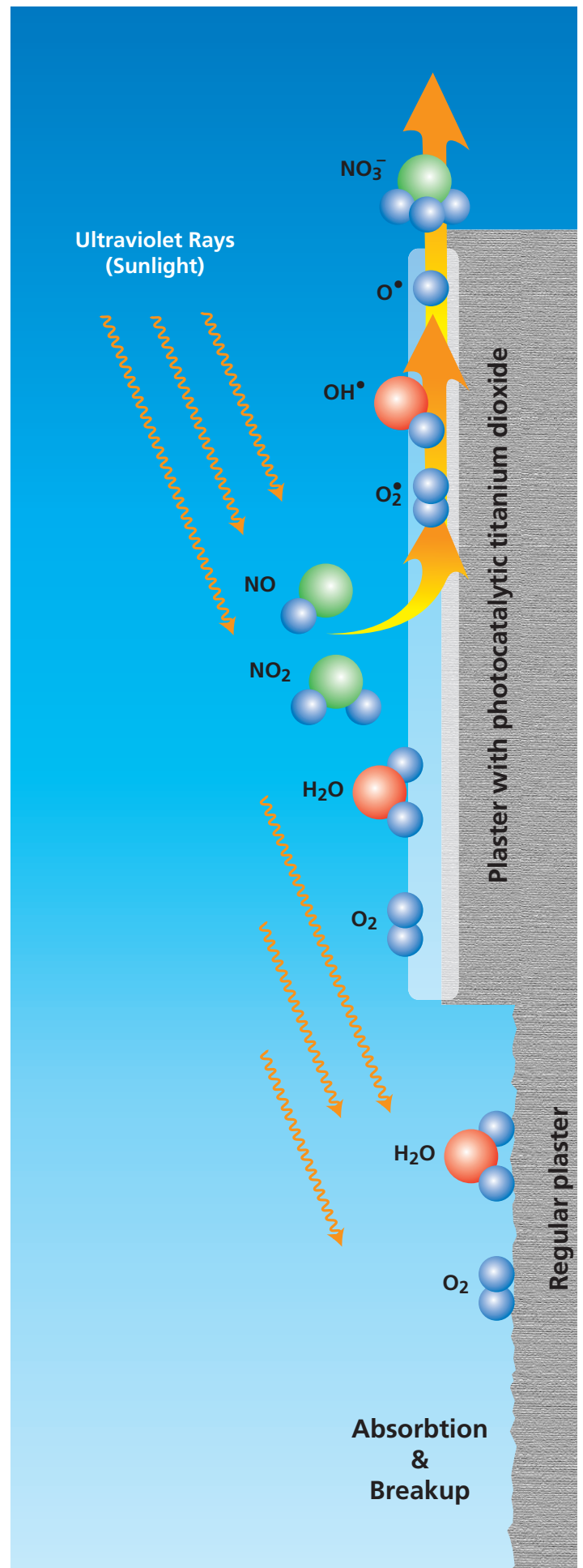
The building industry is a rather quickly expanding industrial branch, which continues to innovate its technological processes and improves properties of building materials. Usage of photocatalytic TiO_2 in powder form in chosen matrixes of building materials is one of possibilities. The powder TiO_2 is from the point view of terminology described as so called powder constituent of inert type (I). Such a constituent is possible to be added directly into cement, fresh concrete, silicate paste plaster materials and paints.

The complicated photocatalytical process is realised in case of cement or fresh concrete on the surface of set concrete only. Dosages of TiO_2 are related to cement and application of amounts up to 15% are possible without significant limitation of mechanical and physical properties of concrete.

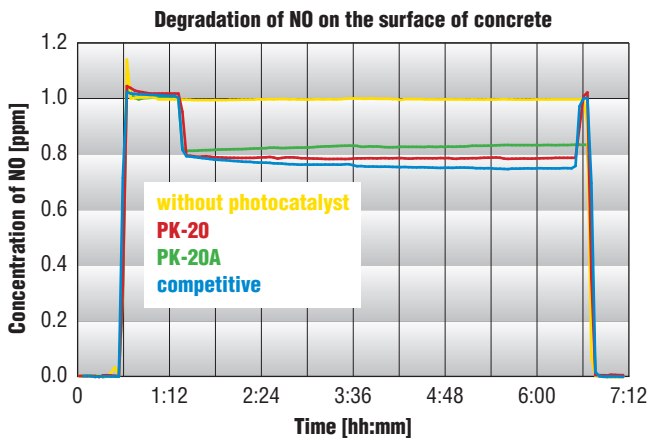
In case of application of TiO_2 directly into cement it is necessary to work in accordance with the standard ČSN EN 197-1, which mentions maximum dosages of the other components in composition of cement.

Testing photoactivity of cements according to UNI 11259

cement	TiO_2	R(4)	R(26)	photoactive
with competitive equivalent	4% of competitive equivalent	32.13	51.18	yes
CEM I 42.5R	4% PK-180	74.64	88.37	yes
CEM I 42.5R	4% PK-60	47.42	80.09	yes
CEM I 42.5R	4% PK-20	45.61	69.01	yes
CEM I 42.5R	4% PK-20A	54.09	91.41	yes



Principle of photocatalysis on the surface of plaster material



Photocatalysts on the base of TiO_2 can also be added in paste plaster materials on the base of silicates, which are applicable in the follow-up for outdoor and indoor usage on new or old bases and on thermal insulation systems. It is a new generation of professional materials with high customer's properties, abundance and easy processibility ensuring high adhesion to all kinds of building bases. Paste plaster materials are delivered in a standard way with content of constituents actively suppressing growth of moss and algae on the surface of these plasters.

In case of application of photocatalytic TiO_2 these additives are not necessary because the photocatalysis reduces strongly catching and growth of microorganisms, algae and mosses on the surface of plaster. Its increased cleanness is insured by this way and, in addition, harmful compounds from air surrounding the surface of plaster are degraded. The application of photocatalytic TiO_2 in paste plaster materials reduces significantly costs for maintenance when cleanness of the surface of plasters is kept. This type of plaster materials can be coloured only with stable inorganic pigments. In case of application of organic pigments the stability of colours is significantly limited by the photocatalytic effect of the present titanium dioxide.

Areas of application of special photocatalytic titanium dioxide PRETIOX

PRETIOX	PK-180	PK-60	PK-20	PK-20A
Building industry				
Renovation of facades	■	■	■	
Cement/concrete	□	□	■	■
Industry of paints				
Silicate paints	□	■	□	□

■ recommended □ application is possible



THE INDUSTRY OF PAINTS

Special grades of titanium dioxide with large surface area and high photocatalytic activity are suitable for application in functional paints. Photocatalytic TiO_2 involved in indoor or outdoor paint causes efficient absorption and following decomposition of toxic gases (NO_x , formaldehyde, ammoniac etc.) on the surface of paints. Besides degradation of toxic gases it is necessary to mention also self-cleaning effect, inhibition of algae, and mildews and removal of foul smell. Paints have high adhesiveness to application surface; outdoor paints have in addition high resistance to abrasion and repulse water. The maximum effect for outdoor application is met by using a mixture of rutile pigment and anatase nanoparticles – the rutile modification of TiO_2 protects deeper layers of paint against UV irradiation and highly photoactive anatase nanoparticles cause photocatalytic corrosion of the thin surface layer of top-coat. Inorganic-based substrate should be used otherwise it would happen to interact with its organic components. Photocatalytic functional paints had been prepared in a narrow cooperation with institutions involved in preparing paints and their long-term efficiency was tested with very good results (rhodamine tests and quantitative dynamic tests).

Photocatalytic titanium dioxide PRETIOX types PK preserve standard coating parameters and brings new quality to indoor and outdoor coating systems.

Typical physical and chemical properties

	PK-180	PK-60	PK-20	PK-20A
TiO_2 [weight %]	> 99.0	> 97.5	> 92.5	> 87.5
crystal modification	anatase	anatase	anatase	anatase
Specific surface area [m^2/g] BET (5 points)	10-13	20-30	70-110	70-110



AGROFERT HOLDING, a.s.
a branch enterprise PRECOLOR
Nábř. Dr. E. Beneše 1170/24
751 52 Přerov
Czech Republic

Phone: +420 581 706 831
Fax: +420 581 706 830
E-mail: precolor@precolor.cz
<http://www.precolor.cz>



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