Crystalline titanium dioxide (TiO$_2$) – A material with excellent potential for innovative products

- Effective photocatalytic material
- Photocatalysis
  - Stimulation of oxidation and reduction processes after activation of the layer (Exposure with UV-A or sunlight)
  - Decomposition of organic and inorganic substances on the surfaces
- Photo-induced hydrophilicity (super-wettability)
  - Reduction of the contact angle against water below 10 °C after activation of the layer
  - Formation of a closed water film on the surface

Application examples for photocatalytic TiO$_2$ coatings

- »Easy to clean effect« (Cleaning alleviation) due to scouring and entrainment of dirt particles as well as to a water film that is planedrained without formation of drops or blotches
- »Self-cleaning« – Decomposition of adhering dirt particles due to oxidation and reduction processes
- »Anti-microbial effect« and »self-sterilisation« – Destruction of adhering microorganisms caused by decomposition reactions (without any application of chemical substances e.g. antibiotics)
- »Anti-fogging effect« and prevention of droplet formation – application e.g. mirrors, glasses, and window panes
- Reduction of the flow resistance of water
- Purification of gases and fluids (e.g. air and water) by decomposition of impurities
FEP coating technology – Reactive pulse magnetron sputtering (PMS)

Advantages of this special PVD method in comparison to conventional TiO₂ coating methods:

• Stable vacuum coating process with high uniformity and purity of the layer, suitable also for large area coating
• Adhesion on a large variety of surfaces without binders
  Solution to the »immobilisation problem« of the powder coating methods
• High effectiveness through large effective TiO₂ surface
• Process parameters adjustable in a wide range
  Adjustment of crystallinity and many other layer properties possible
• Deposition of amorphous or crystalline titanium dioxide layers (Anatase or rutile modification)
  Crystalline layer structure already at a substrate temperature of 130 ... 250 °C (350 ... 450 °C using other methods)

The activation can take place within minutes to hours with UV light, daylight or with indoor commercial fluorescent light and lasts for many hours without irradiation:

Advantages

Innovative photocatalytic and photoinduced hydrophilic properties increase the serviceability of your product:

• Durable properties due to no consumption of the layer material
• Environmentally friendly as there is no release of chemicals from the coating
• Activation is controllable with lighting
• High productivity of the coating technique enables economical production
• Wide assortment of substrate materials can be used for coating at comparatively low temperatures, even certain plastics
• PMS is suitable for coating of 3D substrates

Fraunhofer Institute FEP, your competent partner, offers:

Coating and material development
• Technologies for layer materials with product specific requirement profiles on substrates made of glass, metal, ceramics and plastics

Process development and implementation
• Development and delivery of integrated coating systems as well as of basic methods and process components
• Implementation know how of coating technique and technology on many research/development and production plants
• Experience from intensive activities on the Japanese market, where the application of photocatalytic coatings is more sophisticated

Manufacturing of prototypes and pilot production
• On FEP’s industry like coating plants

Examples of TiO₂ layers with different microstructure and phases, obtained by variation of pulse parameters of the PMS technology.