

Anti-microbial, Easy-to-clean Coatings on Metals, SS, Glass and Plastic

Key Features:

- Incorporation of anti-microbial nanoparticles, controlled release mechanism
- Easy-to-clean coatings have surface properties comparable to perfluorinated polymers (hydrophobic surface)

Potential Applications:

- SS sheets in hospital wall panels
- Medicine/Pharmaceutical: Medicine bottles/containers
- Health care: Hearing aids, hospital furniture
- Food packaging
- Textile and fabric: textile walls and textile roofs, sun shades, blinds

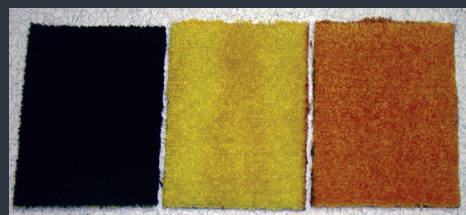
Self-cleaning, Photocatalytic Coatings on Metals, Glass and Ceramics

Key Features:

- Self-cleaning and self-sterilizing surfaces
- Hydrophilic surface formation facilitating easy cleaning by rain or rinsing with water (self-cleaning effect)
- Self-cleaning coatings activated by sunlight/artificial UV light
- Long life, strongly enhanced UV protection by TiO₂

Potential Applications:

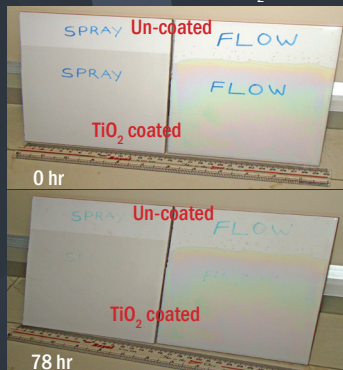
- Architectural glass and tiles
- Medical/Pharmaceutical: Medicine bottles/containers
- Textiles and fabric: textile walls, textile roofs, sun shades and blinds



Anti-microbial coatings for door mats



Physical appearance of TiO₂ thin film



Demonstration of self-cleaning effect on flow and spray coated glazed ceramic wall tiles - Methylene blue stain

The Centre can take up development of targeted applications of specific interest to industries and eventually transfer the pertinent know-how to the concerned entrepreneurs/industries.



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INTERNATIONAL ADVANCED RESEARCH CENTRE FOR POWDER METALLURGY AND NEW MATERIALS (ARCI), HYDERABAD, INDIA

CENTRE FOR SOL-GEL COATINGS

Nanotechnology is one of the key technologies of the 21st century and sol-gel processing is one of the different wet chemical methods that can create nanocrystalline or nanoscaled amorphous materials. Sol-gel method has about three decade long history, starting with processing of oxide materials including glass and ceramics in early days to preparation of non-oxides as well in the recent times. Processing of organic-inorganic hybrid nanocomposite materials using this technique is now an active field of research. The advantage of an organic-inorganic hybrid is that it can favorably bring synergy between the dissimilar properties of organic and inorganic components in a single material. Sol-gel derived hybrid nanocomposite material synthesis involves the poly-condensation of organically modified silanes along with silicon or metal alkoxides. Out of the various material forms that sol-gel processing can lead to such as, generation of:

- a) dense ceramic bodies;
- b) coatings/thin films;
- c) aerogels;
- d) monoliths; and
- e) ceramic fibres,

hybrid nanocomposite coatings generated by sol-gel process are extremely promising for commercial exploitation due to the following advantages:

- Eco-friendliness
- Possibility to tailor properties at nanoscale
- Multi-functionality
- Good mechanical properties due to inorganic network
- Flexibility of coating and compatibility with organic paints due to organic moiety
- Possibility of thick coatings due to independently polymerizable organic groups
- Suitability for deposition on different substrate materials such as metals/SS, ceramic tiles, glass, plastics
- Low temperature ultraviolet (UV)/near-infrared (NIR) curability
- Amenability for deposition on large areas with robotic automation
- Scalability of sol synthesis and coating deposition

The Centre for Sol-gel Coatings at ARCI, Hyderabad established recently is equipped with state-of-the-art facilities for pilot scale demonstration of all associated operations of the coating technology. The Centre is now working with several industrial partners for development and demonstration of sol-based nanocomposite coatings for a wide variety of applications. The Centre is also pursuing basic research for further improving the technology. By virtue of the above mentioned advantages and the varied functionalities that the coatings can yield, they can be adopted to a broad spectrum of applications. Some applications are presented inside.

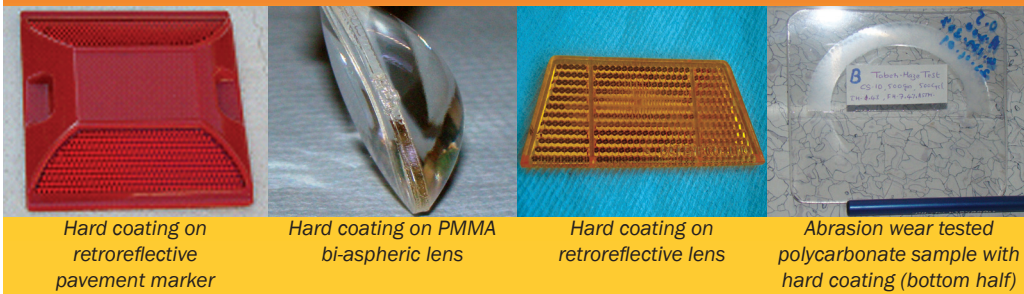
Hard Coatings on Plastics

Key Features:

- High scratch hardness and abrasion resistance
- Long life
- Good adhesion
- Coloured coatings possible
- Can be coated on Polycarbonate, PMMA etc.
- Can be made easy-to-clean with low surface free energy

Potential Applications:

- Road transport: Road and pavement markers
- Helmet visors
- Automotive headlamps
- Coloured head lamps for improved aesthetic appeal and style
- Ophthalmic lenses
- Ophthalmoscopic lenses

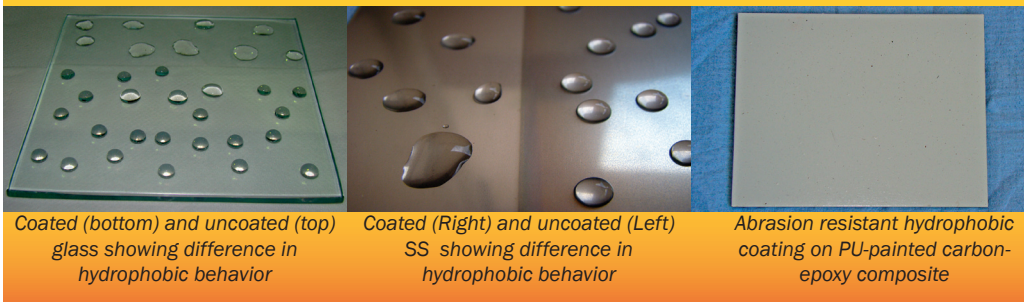


Hard coating on retroreflective pavement marker

Hard coating on PMMA bi-aspheric lens

Hard coating on retroreflective lens

Abrasion wear tested polycarbonate sample with hard coating (bottom half)



Coated (bottom) and uncoated (top) glass showing difference in hydrophobic behavior

Coated (Right) and uncoated (Left) SS showing difference in hydrophobic behavior

Abrasion resistant hydrophobic coating on PU-painted carbon-epoxy composite

Easy-to-Clean Coatings on Metals, SS, Glass, Plastic, Ceramics

Key Features:

- Transparent or coloured
- Hydrophobic surface formation facilitating easy cleaning by rain or rinsing with water
- Avoids formation of streaking caused by the flowing water
- Easy-to-clean surfaces against graffiti and stains caused by coffee, tea, colas and household oils

- Less susceptible to the growth of micro-organisms
- Remains clean for longer periods

Potential Applications:

- Architectural glass sheets
- Aluminum mirrors in Solar collectors
- Medical and health care
- Railway carriages and public utility areas
- Aircrafts

Glass-like Corrosion Protection Coatings for Metals, SS

Key Features:

- Anti-fingerprint, easy-to-clean
- High scratch hardness and abrasion resistance
- High temperature tarnish protection
- Low temperature curable compositions used as replacement for chromate-free primers
- Protection against acid attack and ion leaching
- Coloured coatings possible

Potential Applications:

- Household appliances
- Medicine and health care: medical/surgical instruments
- Automotive: exhaust parts for motor cycles, cars
- Architectural



Transparent, corrosion and scratch resistant coatings on carbon steel

Coloured, tarnish-resistant, glass-like coatings on stainless steel

Coloured, corrosion resistant coating on Al after 720 h salt spray test



(a) Transparent coloured coatings (a) for interior applications (b) on glass panes (c) for glassware

(b)

(c) Opaque and scratch resistant coloured coatings on glass

Decorative Coatings on Glass and Ceramics

Key Features:

- Adjustable transmission and refractive index of the coatings
- Colour of the coating can be controlled by suitable choice of dopants
- UV, temperature stable and weather proof
- Recyclability of glass due to complete degradation of organic constituents at high temperatures
- Opaque coatings possible with high temperature durability

Potential Applications:

- Glass and Ceramic industry: coloured glasses for aesthetics or decoration
- Scratch resistant coloured coatings for glass bottles used in various industries such as perfume, liquor and fashion fields
- Architectural applications