



Industrial Consultancy & Sponsored Research (IC&SR)

Titania-Silica Coating for (i) Protection of Metal Surfaces and (ii) Ophthalmic Coating Applications

IITM Technology Available for Licensing

PROBLEM STATEMENT

- Protection of metal surfaces, particularly the optical shine of silver, against the environment is a challenge. Daily usage of silver articles (mainly, the cutlery, crockery and the tableware) needs special protection against mechanical abrasion. The coatings technology imposes additional challenge of complex shapes of the silver / metal articles.
- When high refractive index ophthalmic lenses are to be used, one needs an anti-reflection coatings which should have high and uniform (over the entire visible wavelength range) refractive index and abrasive resistance coatings compatible with lens coating technology.
- **Hence, there is a need to address the issues.**

INTELLECTUAL PROPERTY

IITM IDF Ref. 1744; IN Patent No: 526956

TECHNOLOGY CATEGORY/MARKET

Technology: Titania-silica Coating;

Industry & Application: Silver Industry, Jewelry, Ophthalmic lenses

Market: The global silica coating market is projected to grow at a **CAGR** of **9.9%** during **2024-2030**.

TRL (TECHNOLOGY READINESS LEVEL)

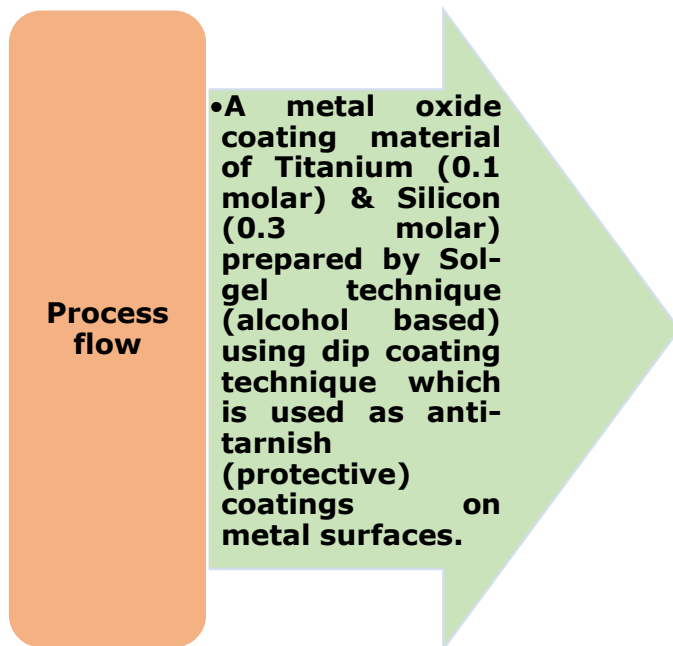
TRL-4, Proof of Concept ready, tested in lab.

TECHNOLOGY

- Present invention describes a **method of preparing a coating material** which is the mixed metal oxides of **Titanium & Silicon** prepared at **300K** (Room temperature).
- The **solution** can be used for **anti-tarnish and protective coatings** on metal surfaces.

The basic method comprising the following step as illustrated in the smart chart:

Basic Process Flow Diagram



- The titania-silica based coating material can be prepared **at room temperature** and can be **deposited** on any **complex shapes** and has **anti-reflection and mechanical abrasion** resistance coating on optical materials.
- Said titania-silica based coating material can be **used as protective coating layer** for **silver metal & silver alloys**.

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TECHNOLOGY (Contd.)

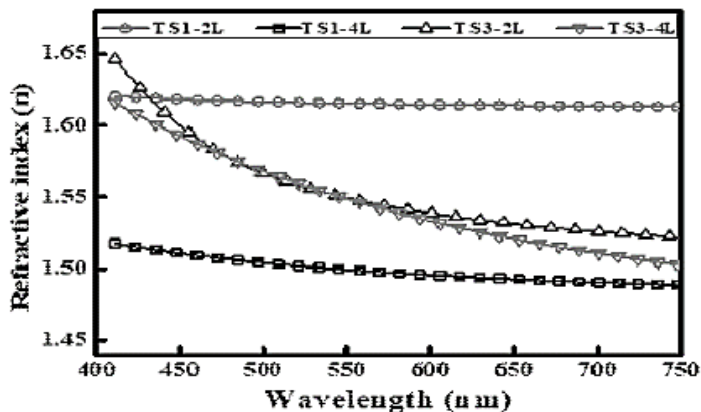


Fig. 1: Variation of refractive index with wavelength for films of TS-1 & TS-3 films coated on glass as 2-layers & 4-layers;

- Furthermore, the claimed invention deals with any wavelength of the anti-reflection application & the refractive index of the present invention is a key outcome which is depicted in Fig. 1.
- The **titania-silica based coating** can be used as **anti-reflection** and **mechanical abrasion resistance coatings** on **optic lenses** including **plastic lenses**.
- The protective coatings are deposited by **dip coating technique of desired thickness**.
- Table 1** provides the summary of **adhesion & hardness results** for **TiO₂, SiO₂, & TiO₂+SiO₂ thin films** on **glass as 2 and 4 layers**.

Test Results

Sample-glass		Adhesion (N)		Hardness (GPa)	
		2-L	4-L	2-L	4-L
TiO ₂	T-1	3.6	8.2	5.3	7.2
	T-3	4.3	11.3	8.9	9.6
SiO ₂	S-1	*	*	*	*
	S-3	*	9.2	*	*
TiO ₂ -SiO ₂	TS-1	4.0	9.5	7.0	7.3
	TS-3	5.1	12.7	10.9	10.9

Table-1

KEY FEATURES / VALUE PROPOSITION

❖ Technical Perspective:

- The **sol-gel** technique to prepare the titania-silica thin films is **easy, cost-effective** & can be **scaled up** to the **Industrial level**.
- The **optical properties** of the **sol-gel derived titania-silica** is unique.
- Dip coating technique of desired thickness**.
- For **significant enhancement** in the **coating performance**, the **coatings can be cured at 200°C for about 20 minutes** either in inert atmosphere or in low vacuum ~ 10⁻² mBar.
- Claimed Sol gel derived titania-silica coating specifically used to **protect silver surfaces** from **sulfide & sulfate**.
- The preparation parameters including **gelling time, pH of the sol, temperature, sol concentrations** determine the properties of the sol and consequently, each sol has a specific application.

❖ Industry Perspective:

- Claimed invention has **multi-utility** in a **wide range of surface protection** of metal/metal alloy & **optical coating applications** where one needs optical refractive index matching and abrasion resistance.

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