

### Process for Preparing a Defect Induced Coloured Titania IITM Technology Available for Licensing

#### Problem Statement

- **TiO<sub>2</sub>** is one of the most widely used **photocatalyst** for several photo catalytic applications owing to its **low cost, low toxicity and high activity**.
- It's a wide band gap **semiconductor** and it absorbs mostly UV light for the photochemical reaction on surface which **hindered** its **practical applications**.
- Therefore, it is essential to find an **alternative to improve** UV active to visible-light driven photocatalyst that is **stable and highly efficient** for many photocatalytic applications.
- The present patent performs **Photocatalytic hydrogen evolution** to understand the **co-relation characteristic** of electronic structure and the **photoactivity** with **Pressure treated nitrogen doped colour Titania**.

#### Technology Category/ Market

**Category:** Chemistry & chemical Analysis

**Industry:** Catalysts/Chemical & Advanced Materials Manufacturing, Photocatalyst

**Applications:** Catalyst/ Photocatalyst, Chemical, photochemical reaction, semiconductor

**Market:** The global methanol market is likely to grow at **4.5% CAGR** from **\$28.7B** to **\$39.2 B2021-2028**.

#### Intellectual Property

TRL – 4; Technology validation in Lab

#### Technology

The present patent discloses a process for preparing a **nitrogen-doped defect induced coloured Titania** prepared by simple two-step process treated in **vacuum, controlled pressure & temperature treatment in N<sub>2</sub> atmosphere**, shown in **Fig. 1 & 2**.

#### Key Features / Value Proposition

- This invention relates to **novel sodium ion** incorporated coloured Titania via chemical reduction method using **NaBH<sub>4</sub>** as a **reducing agent in high pure H<sub>2</sub> atmosphere**.
- This invention discloses the **strategies to generate different defects concentration**, different photo-activity results are observed.
- The **increase of visible-light absorption** may originate from **impurity deep** and **shallow energy levels** within the electronic band structure.

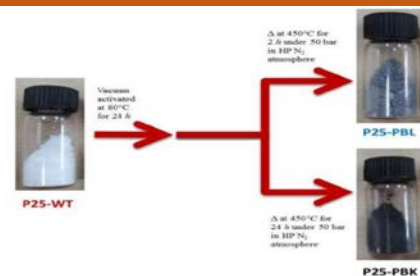
#### TRL (Technology Readiness Level)

IITM IDF Number: 1958

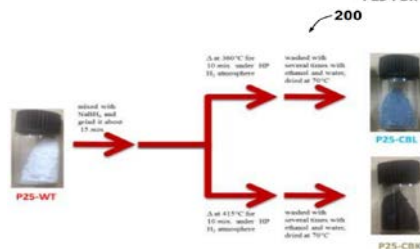
IP Patent Number: 398100 (Granted)

#### Images

**Fig. 1** illustrates the preparation of nitrogen incorporated coloured Titania from pristine (White) Titania P25-WT



**Fig. 2** illustrates the preparation of sodium ion incorporated coloured Titania from pristine (White) Titania P25-WT.



#### Process

Producing a nitrogen-doped Titania photocatalyst by simple two-step process starting from commercial grade (Aeroxide P25) wherein nitrogen-doped Titania is treated in vacuum & subjected to controlled pressure & temperature treatment in N<sub>2</sub> atmosphere that give rise to colour TiO<sub>2</sub> (P25-PBL & P25-PBK).

The nitrogen-doped Titania is treated in vacuum and subjected to controlled pressure and temperature treatment in N<sub>2</sub> atmosphere that give rise to colour (defect) TiO<sub>2</sub> (P25-PBL & P25-PBK).

The defect concentration of electron trapped in vacant sites and Ti<sup>3+</sup> centers, is quantified by EPR and the EPR signal for Ti<sup>3+</sup> centers present in coloured Titania are responsible for photocatalytic hydrogen evolution.

The defect induced coloured Titania do not observe any significant phase transformation from anatase to rutile phase in P25-PBL and P25-PBK.

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