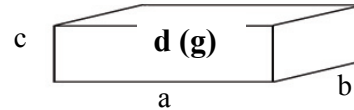


# Calculation of TiO<sub>2</sub> film thickness in theory

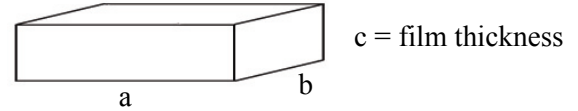
\* Density =  $d \text{ (g)} / (a \times b \times c)$



It is possible to calculate the thickness of film, if the amount of TiO<sub>2</sub> solution that is coated in the area is measured.

\* film density =  $d \text{ (g)} / (a \times b \times \text{film thickness}) \text{ (cm}^3\text{)}$

\* Film thickness (cm) =  $\frac{d}{a \times b \times \text{film density}}$  (1)



After coating, film density concentrates when the temperature of heat treatment becomes high.

The film density approaches to true density. (True density means that it does not contain any air space or non pure substances. It is 100% pure TiO<sub>2</sub> substance)

\* Film density = True density x Relative density (2)

\* True density of anatase TiO<sub>2</sub> type = 3.90g/cm<sup>3</sup>

\* Combine the idea of (1) and (2)

\* Film thickness (cm) =  $\frac{d}{a \times b \times \text{true density (3.90)} \times \text{relative density}}$  (3)

**Example:** 10cm x 10cm ceramic tile  
 Used TPX-85 (0.85 % by weight) for coating on the tile  
 2g of the solution was used  
 It was dried at room temperature.

**tile area:** 10cm x 10cm = 100cm<sup>2</sup>

**amount used for coating:** 2g

**TiO<sub>2</sub> amount in the 2g solution:** 2g x 0.85% = 0.017g

**relative density of TPX-85 when it was dried at room temperature:** 66.3%

$$\text{Film thickness (cm)} = \frac{0.017 \text{ g}}{10\text{cm} \times 10\text{cm} \times 3.90\text{g/cm}^3 \times 0.663} = 0.6575 \times 10^{-6} \text{ cm}$$

$$= 0.6575 \text{ } \mu\text{m}$$

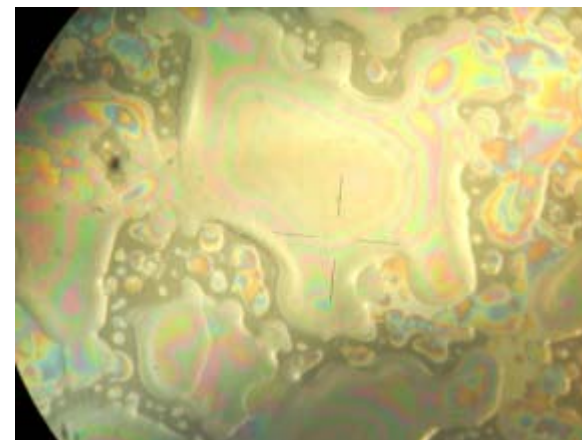
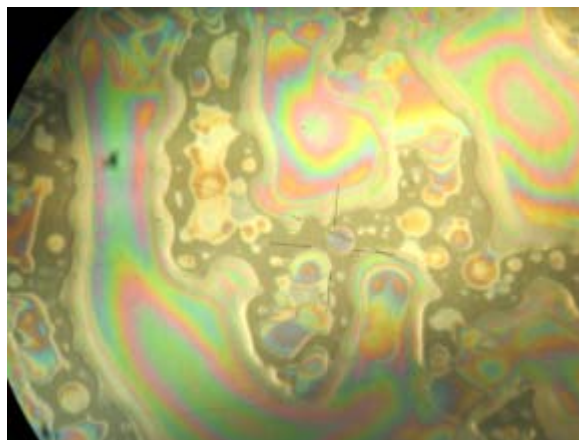
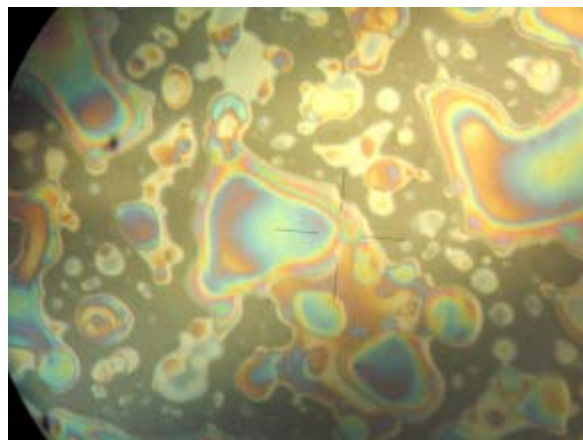
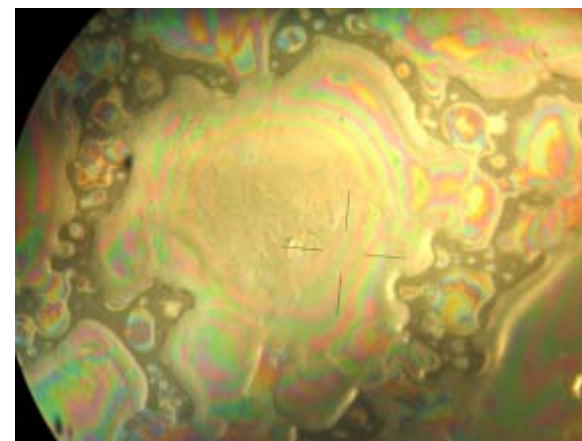
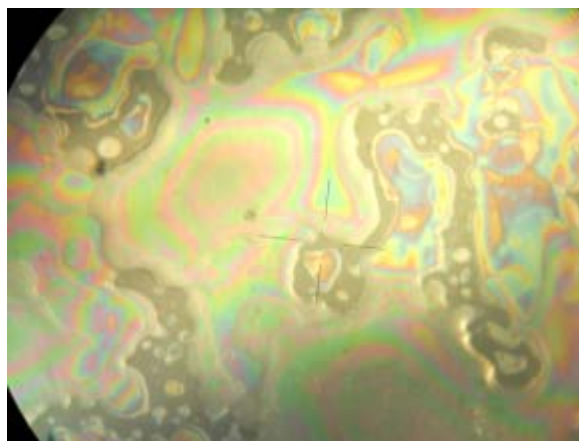
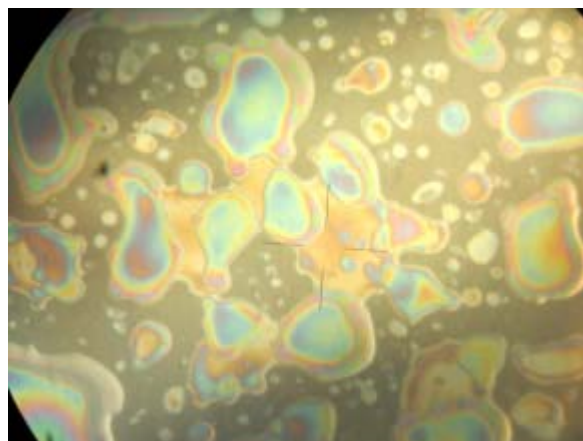
Film thickness ( $\mu\text{m}$ ) =	$\frac{\text{used amount (g) by coating} \times \text{contained \% of TiO}_2}{\text{area} \times \text{true density of TiO}_2 \times \text{relative density of film thickness}} \times 10^4$
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**This is a calculation to find film thickness in theory. The number used as relative density is a non-fixed value. Therefore the answer from the calculation should be considered only for your reference.**

Relative density of each TiO<sub>2</sub> solution

Heat Treatment Temperature (°C)		Dried at room Temperature	100	300	400	500	600
Relative Density (%)	PTA	Predictable #: 60	Predictable #: 68	72	74	85	92
	TO	69	70	75	78	87	95
	TPX	Predictable #: 66.3	Predictable #: 69.4	Predictable #: 74.1	Predictable #: 76.8	Predictable #: 86.4	Predictable #: 94.1

# Green Millennium photocatalyst-film thickness comparison



**0.1  $\mu\text{m}$**

**0.25  $\mu\text{m}$**

**0.4  $\mu\text{m}$**