PHOTOCATALYTIC ACTIVITY OF TiO_2-EMBEDDED FLUORINATED TRANSPARENT COATING FOR OXIDATION OF HYDROSOLUBLE POLLUTANTS IN TURBID SUSPENSIONS

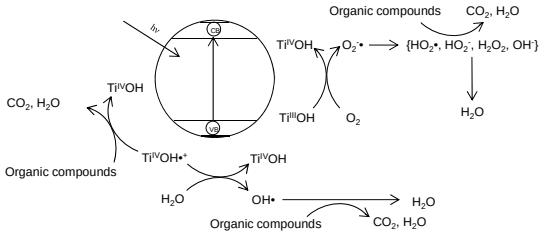
Federico Persico[a,b], Valentina Rizzi[a,b], Maurizio Sansotera[a,b], Walter Navarrini[a,b]

[a]*Dipartimento di Chimica, Materiali e Ingegneria Chimica "G. Natta", Milano, 20131, Italy*
[b]*Consorzio Interuniversitario Nazionale per la Scienza e Tecnologia dei Materiali, Firenze, 50121, Italy*

(*) corresponding authors: maurizio.sansotera@polimi.it, federico.persico@polimi.it

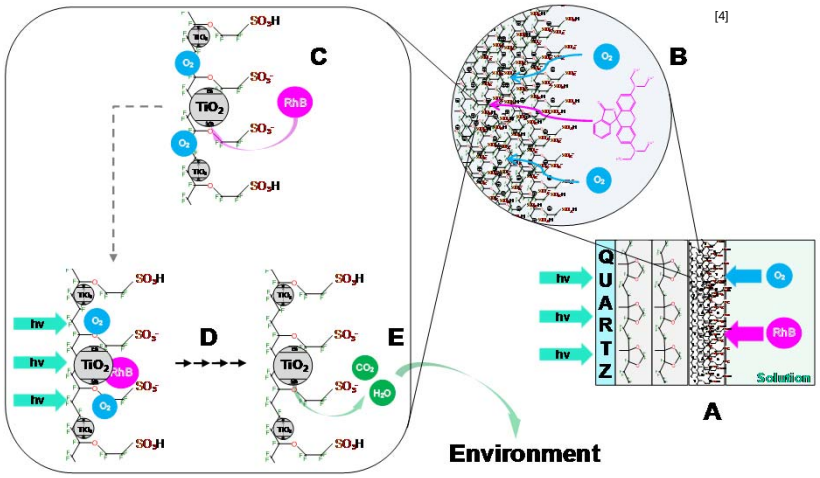
AIM OF THE RESEARCH

Production of a chemically stable and resistent coating, able to promote the *photooxidation* of hydrosoluble organic pollutants[1-3]:



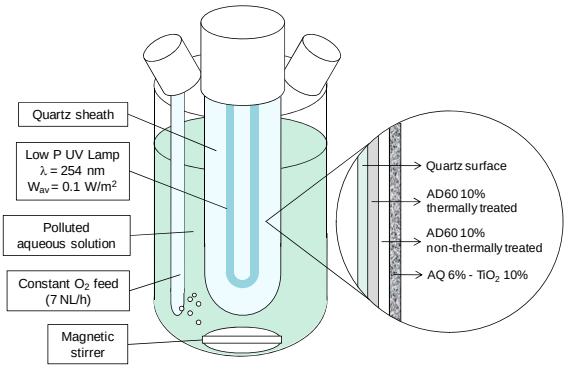
TiO_2 immobilizer: polymeric matrix → Chemical stability, UV transparency, Gas permeability, Hydrophilic → **IONOMERIC AMORPHOUS FLUOROPOLYMERS**

PHOTOCATALYTIC COATING OPERATING MODE

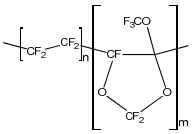


A migration of RhB and O_2 towards the aqueous solution-polymer interface
B RhB and O_2 phase-transfer and diffusion into the ionomeric phase
C RhB and O_2 adsorption on TiO_2 particles
D stepwise RhB degradation by photoactivated TiO_2 particles
E retrodiffusion of mineralized products in the aqueous phase

EXPERIMENTAL APPARATUS



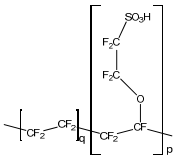
Hyflon® AD60
Solvay Specialty Polymers



[5,6]
m/n = 60/40

- TFE-MDO copolymer
- High chemical stability
- High UV transparency
- High hydrophobicity

Aquivion® D83-06A
Solvay Specialty Polymers



[7]
p/q = 15/85

- TFE-SFVE copolymer
- High chemical stability
- High UV transparency
- Strong acid behaviour
- Hydrophilicity

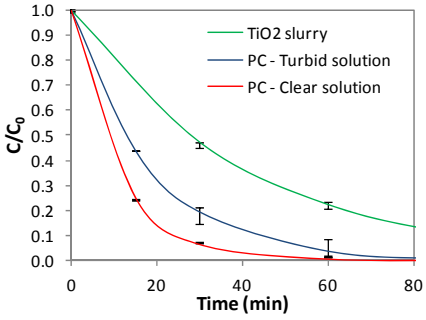
RhB PHOTODEGRADATION

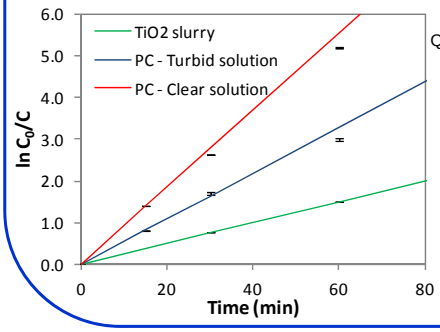
Pseudo-first order degradation kinetics

$$\frac{C}{C_0} = \exp(-k_{app} \cdot t)$$

Test	k_{app} (min^{-1})[a]	Δ [RhB]60 (%)[b]
PC - Clear solution	0.0923	99.4
PC - Turbid solution	0.0546	95.0
TiO_2 slurry	0.0250	77.9

[a] Correlation coefficients R^2 higher than 0.99 for all the tests presented
[b] RhB concentration decrease calculated after 60 min treatment





Quantum yield (QY) and quantum efficiency (QE) evaluation[4]

$$QY = \frac{k_{app} \cdot [RhB]_0 \cdot V}{\Phi_{Abs}} \qquad QE = \frac{k_{app} \cdot [RhB]_0 \cdot V}{\Phi_{IN}}$$

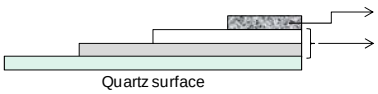
Test	k_{app} (min^{-1})[a]	QY (%)	QE (%)
PC - Clear solution	0.0923	92	49
TiO_2 slurry	0.0250	23	13

[a] Correlation coefficients R^2 higher than 0.99 for all the tests presented

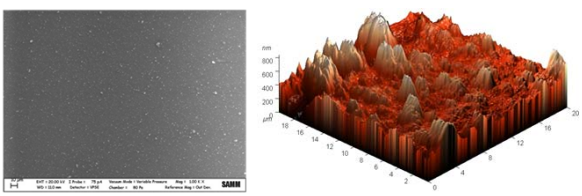
CONCLUSIONS

- TiO_2 immobilization allows the realization of a **self-cleaning photocatalytic assembly**
- The coating can be successfully employed to treat **turbid solutions**
- The photoactive coating guarantees **higher abatement rates** than TiO_2 slurry
- The coating guarantees **higher QY** and **QE** than TiO_2 slurry

COATING CHARACTERIZATION



Layer	Average Thickness (μm)
AQ 6% - TiO_2 10%	3.70 ± 0.44
Double AD60 10%	2.11 ± 0.19
Photoactive Coating	5.81 ± 0.63



Evidence of TiO_2 clusters
↓
Improvable system efficiency

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