

# Photocatalytic properties of atomic layer deposited TiO<sub>2</sub> inverse opals and planar films for the degradation of dyes

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## Supplementary Data

### 1 Morphological characterizations by SEM

The morphology of the inverse opals (IO) films was studied by scanning electron microscopy (SEM) by using a JEOL 7600F working between 1 and 3 kV. A surface ion-polishing of the inverse opals samples was used to crush the TiO<sub>2</sub> shells in order to investigate their inner side. The ion-polishing process was done during 15 min by using an Ar<sup>+</sup> beam with an energy of 4 keV.

Figure S1 shows the surface view of a layer of PS beads covered by an ALD film of TiO<sub>2</sub>. The substrate was a silicon wafer. The sample has been ion-polished up to remove nearly the top half of the PS beads. The image shows the conformity of the TiO<sub>2</sub> film covering the PS beads.

Under the upper layer of PS beads, other layer of beads can be observed through the empty space between the spheres of the upper layer. Figure S2 shows a view focused on the bottom layer of spheres. The TiO<sub>2</sub> film which covers the bottom layer of beads is observed.

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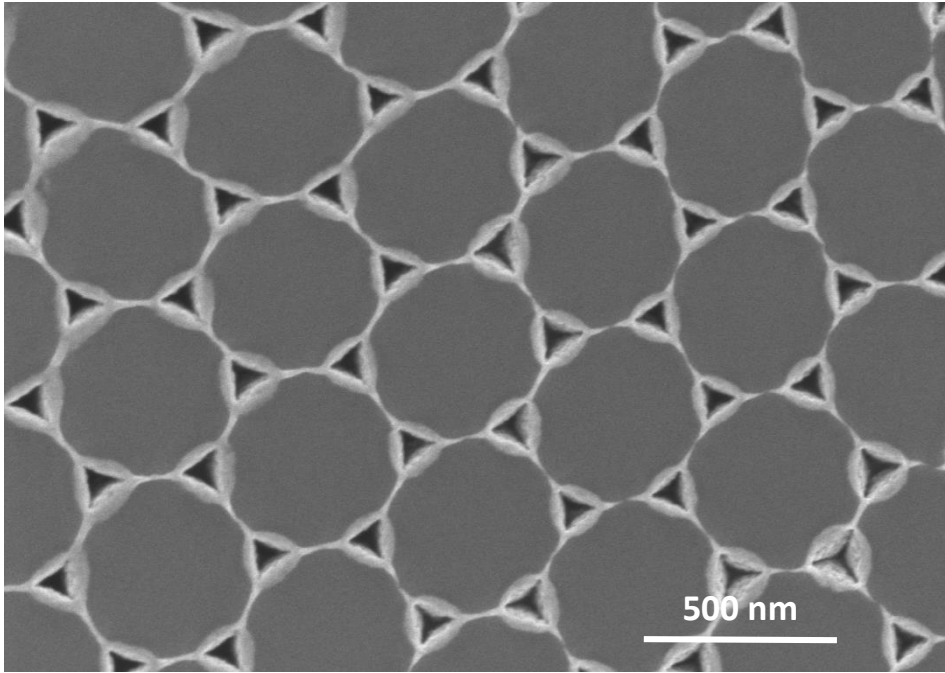


Fig. S1. FE-SEM surface image of a layer of PS beads on a Si substrate. The beads have been covered by a film of  $\text{TiO}_2$  deposited by ALD. The sample has been ion-polished up to remove nearly the top half of the PS beads. Image taken in the secondary electrons mode.

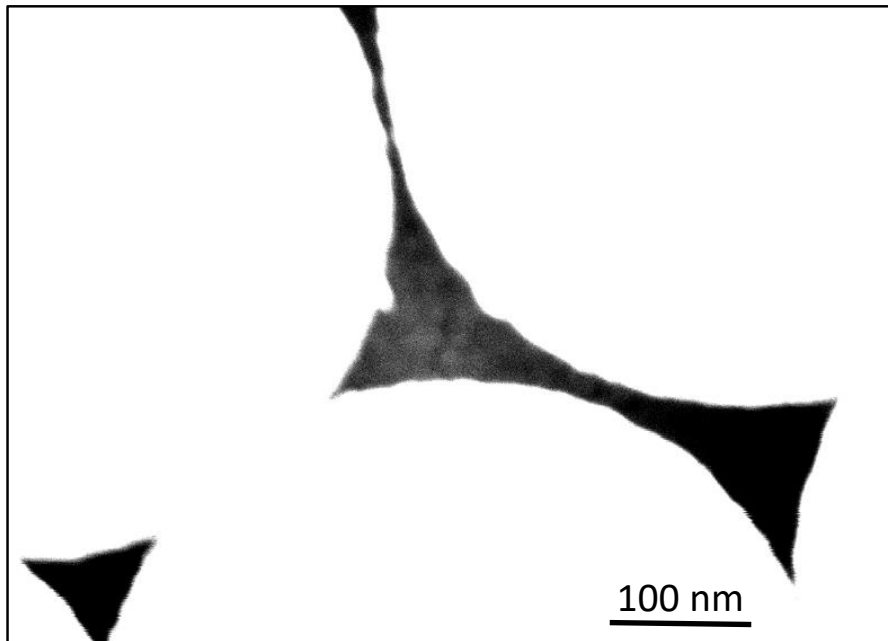


Fig. S2. FE-SEM surface image of a  $\text{TiO}_2$  inverse opal film (250 ALD cycles) after annealing at  $380\text{ }^\circ\text{C}$ . The image is focused on the bottom layer of  $\text{TiO}_2$  shells, which can be observed through the empty spaces between the shells of the top layer. The brightness of the image has been strongly increased to improve the observation of the bottom layer, the top layer appears in white.

Figure S3 shows a top view of a TiO<sub>2</sub> IO film (250 ALD cycles) after annealing at 380 °C and ion-polishing of the annealed sample. The image shows that polystyrene has been completely removed by the annealing treatment.

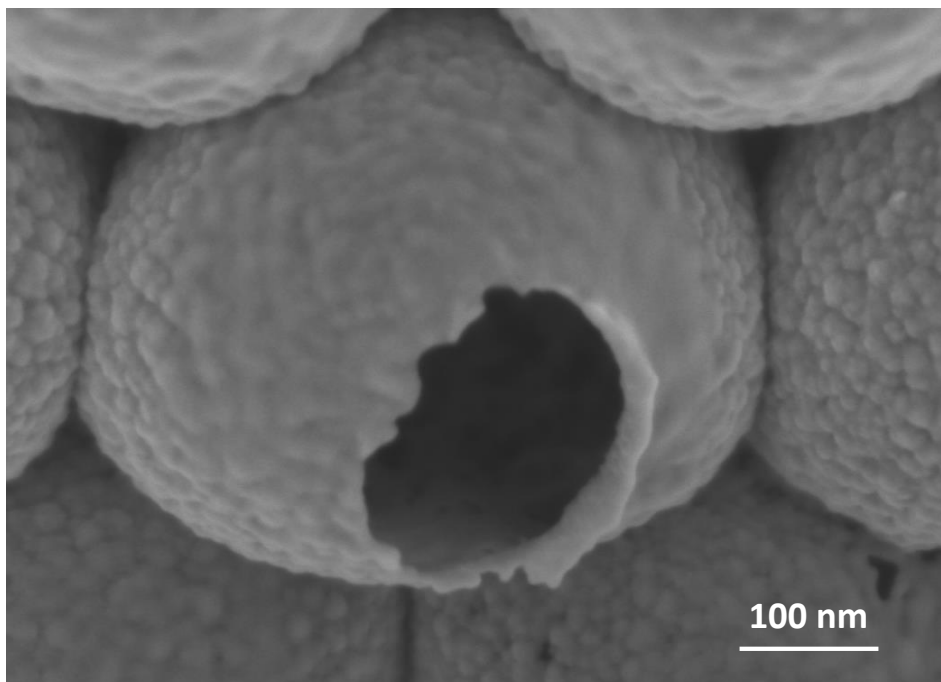


Fig. S3. FE-SEM surface image of a TiO<sub>2</sub> inverse opal film (250 ALD cycles) after annealing at 380 °C and ion-polishing of the annealed sample.

## 2 Photocatalytic tests: degradation of methylene blue

The degradation reaction of methylene blue (MB) was used to study the photocatalytic activity of the IO films compared to dense and porous TiO<sub>2</sub> films. The evolution over the time of the MB solution concentration was measured by UV-Vis optical absorption. Previously, the eventual degradation of MB under UV irradiation in the absence of any catalyst was also studied.

Figure S4 shows the optical absorption spectrum of a MB solution concentrated at 1  $\mu$ mol/L compared to that obtained after UV irradiation during 48h. A small decrease, about 4.8%, is observed in the intensity of absorption band of MB. This effect is quite small compared to that obtained with the different photocatalysts studied in this work, which exceeds 50% of MB degradation in all the cases.

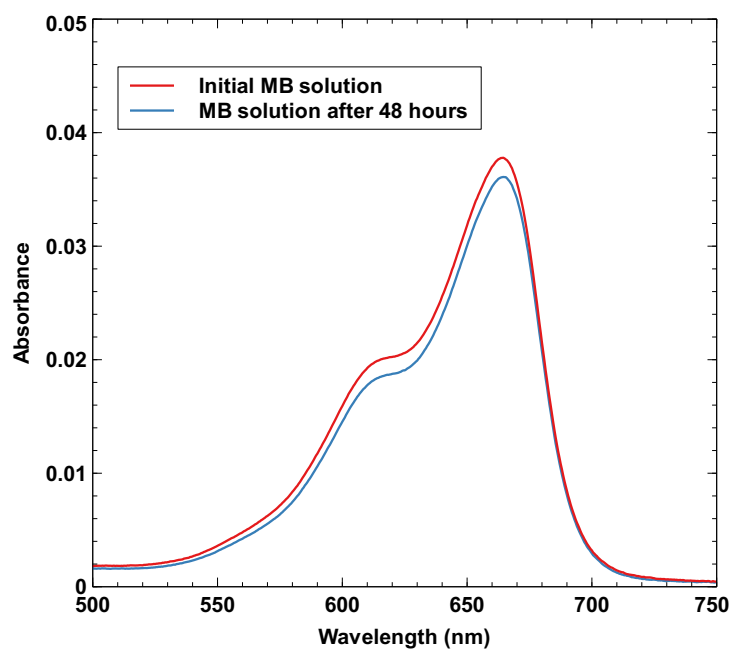


Fig. S4. Optical absorption spectra of a MB solution initially concentrated at  $1 \mu\text{mol/L}$  and after 48 hours of UV irradiation in the absence of any photocatalyst.