Electronic Supplementary Information

Mesoporous $\alpha$-Fe$_2$O$_3$ Thin Films Synthesized via the Sol-gel Process for Light-driven Water Oxidation

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<table>
<thead>
<tr>
<th>Temperature (°C)</th>
<th>Crystallite size (nm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>400</td>
<td>14</td>
</tr>
<tr>
<td>425</td>
<td>15</td>
</tr>
<tr>
<td>450</td>
<td>18</td>
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<tr>
<td>500</td>
<td>30</td>
</tr>
<tr>
<td>600</td>
<td>47</td>
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</table>

**Table S1.** Evolution of the size of the crystallites in the hematite films as a function of the sintering temperature.

**Figure S1.** Size distribution of the micelles in the sol-gel solution from dynamic light-scattering measurements.

**Figure S2.** Refractive index (blue) and its derivate as functions of the temperature for hybrid organic-inorganic films: variation of the thickness (dark blue) and derivate of the thickness (red) as functions of the temperature.
Figure S3. SEM images collected for $\alpha$-Fe$_2$O$_3$ thin films heat treated at various temperatures in air.

Figure S4. X-ray photoelectron spectroscopy survey data for the $\alpha$-Fe$_2$O$_3$ thin films sintered at 500°C (blue) and 750°C (green). The presence of Sn dopant is only observed in the sample sintered at 750°C.

Figure S5. FE-SEM images of Co-modified 500 °C heat-treated 5-layersmesoporous films. Left. Impregnated; Middle electro-assisted deposition; Right. photo-assisted deposition.
Figure S6. Current density vs applied potential (j-V) plots recorded at 5 mV.s\(^{-1}\) in 0.1 M KOH (pH 13) in the dark (dashed) and under illumination (plain) for pristine 750 °C heat-treated 5-layers mesoporous films. The response for the same Co-impregnated sample is shown in blue.

Figure S7. Current density vs applied potential (j-V) plots recorded at 5 mV.s\(^{-1}\) in 0.1 KPi buffer (pH = 8) in the dark (dashed) and under illumination (plain) for pristine 750 °C heat-treated 5-layers mesoporous films.
**Figure S8.** Current density vs applied potential (j-V) plots recorded at 5 mV.s⁻¹ in 0.1 KPi buffer (pH = 8) in the dark (dashed) and under illumination (plain) measured for 500°C heat-treated 5-layers mesoporous nanostructured hematite films decorated with electrodeposited O₂-CoCat.

![Graph showing j-V plots](image)

**Figure S9.** Current density vs applied potential (j-V) plots recorded at 5 mV.s⁻¹ in 0.1 KPi buffer (pH = 8) in the dark (dashed) and under illumination (plain) measured for 500°C heat-treated 5-layers mesoporous nanostructured hematite films decorated with photo-electro deposition O₂-CoCat.

**Figure S10.** Schematic setup for incident-photon-to-current efficiency measurement.

![Schematic diagram](image)

**Figure S11.** Wavelength-dependent optical power reaching the sample during the ICPE measurement.