Electronic Supplementary Material (ESI) for Journal of Materials Chemistry A

Supporting Information

Dye Sensitized Nanostructured Crystalline Mesoporous Tin-doped Indium Oxide Films with Tunable Thickness for Photoelectrochemical Applications

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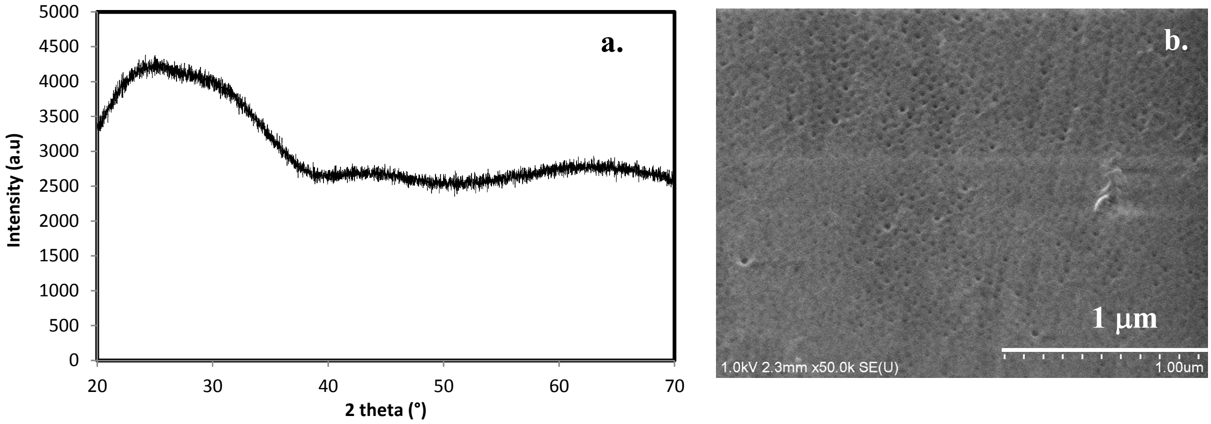


Figure S1. X−Ray diffraction patterns (**a**) and FE−SEM images (**b**) of *templated nano-ITO* films before thermal treatment.

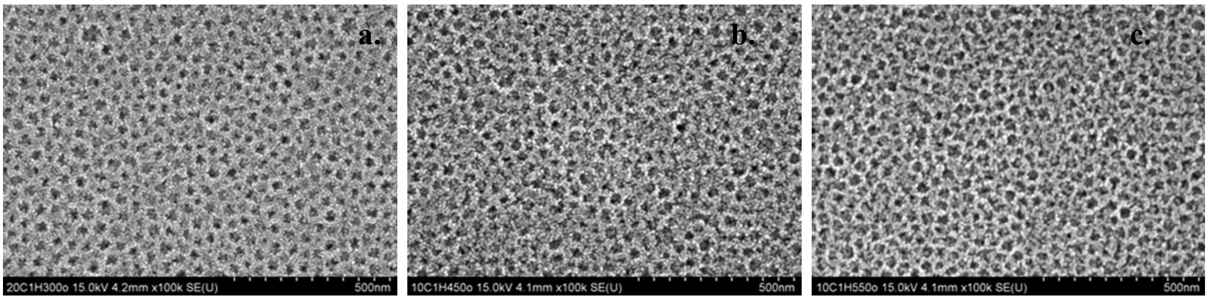


Figure S2. FE−SEM images of *templated nano-ITO* films treated at various temperatures a) 300°C, b) 450°C, c) 550°C in air

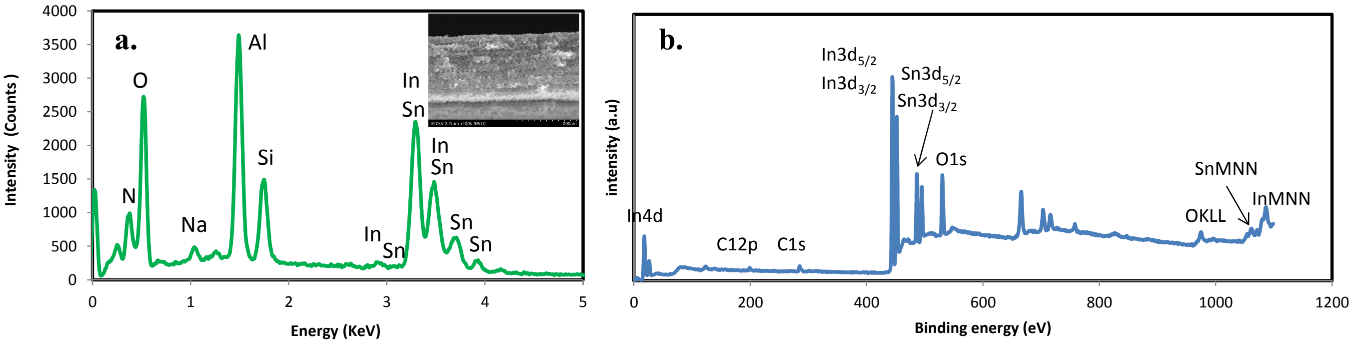


Figure S3. EDX (**a**) and XPS (**b**) analyses for *templated nano-ITO films* heat-treated at 450°C in air

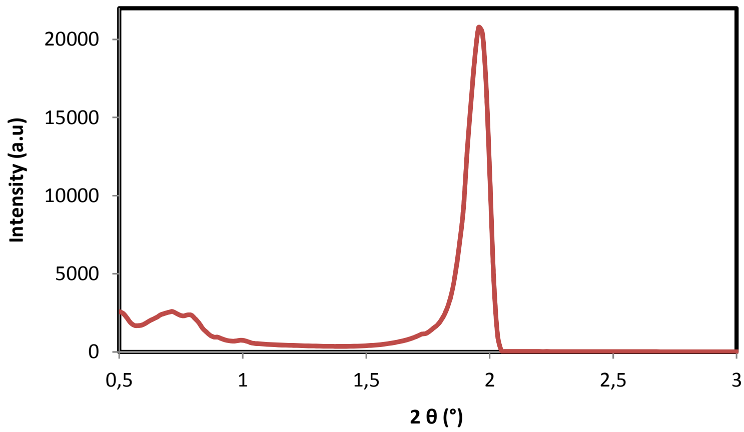
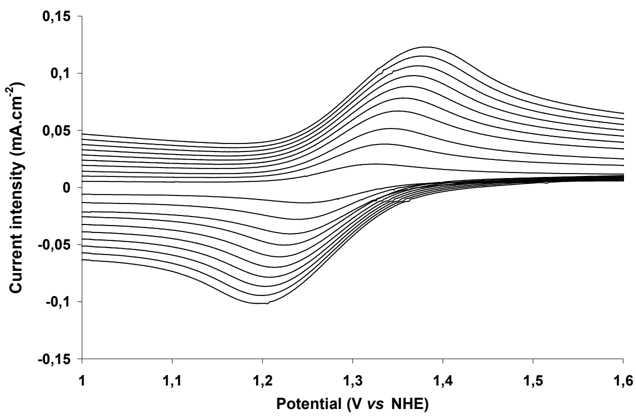


Figure S4. Small−angle X−ray diffraction of *templated nano*−ITO films calcined at 450°C. The most intense peak can be attributed to the (220) of mesopores organized into a cubic structure. The peaks before are due to interference.

Table 1. Crystallites size as function of the heat-treatement. Evolution of the crystallites size as function of the heat-treatment, determined from Debye and Scherrer formula (noted D(222)sherrer in the table), Dmean corresponds to mean diameter obtained by this method, and from Williamson et al. approach (noted D Williamson et hall in Table 1).

Temperature	D (222)-Scherrer	D mean	D williamson et Hall
300 °C	15 nm	15,6 nm	16,6 nm
450 °C	21 nm	20,4 nm	25 nm
550 °C	23 nm	21,5 nm	30 nm



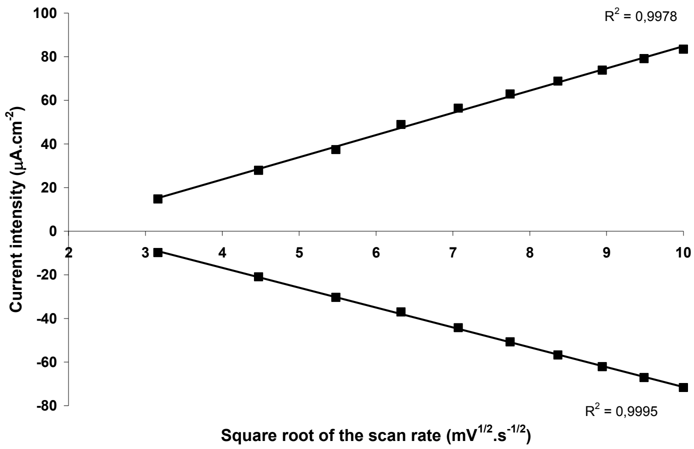


Figure S5. *Top* Cyclic voltammograms of $[Ru(bpy)_3]Cl_2$, 1 mM in 0.1M aqueous HOTf at scan rates varying from 10 to 100 mV.s^{-1}, recorded at a non-functionalized nanostructured ITO electrode (10 layers, treated at 450°C for 1 hour in air; electrode surface: 1 cm^2). *Bottom* Linear evolution with the square root of the scan rate of the cathodic and anodic peak currents (capacitive current substracted) related to the Ru^{III}/Ru^{II} couple.

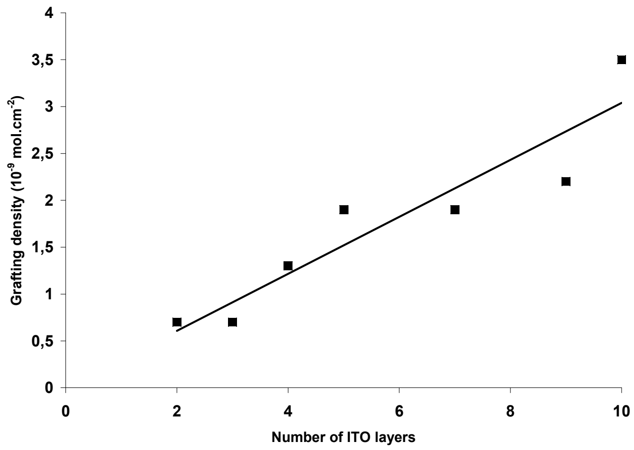
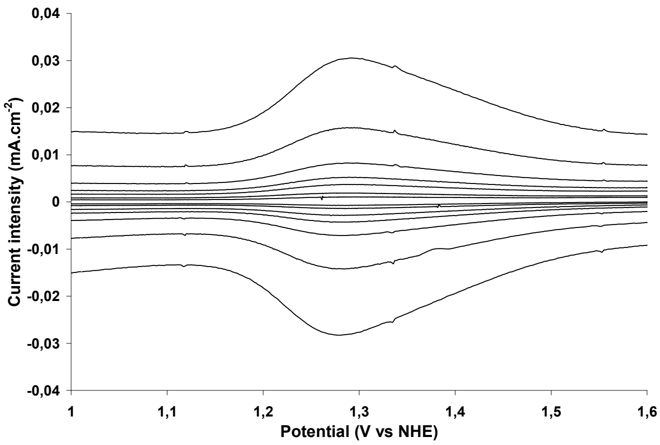


Figure S6. Dependence of the grafting density on the number of layers for multi-layered nanostructured ITO films.



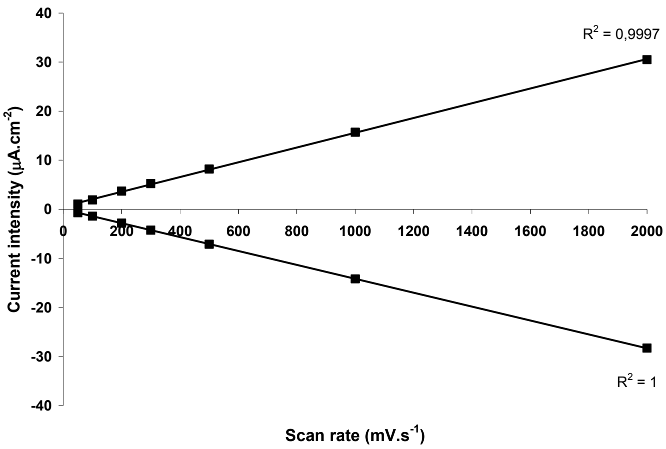


Figure S7. *Top* Cyclic voltammograms of complex **1** adsorbed on planar ITO (electrode surface: 1 cm^2), recorded in 0.1M aqueous HOTf at scan rates varying from 50 to 2000 $mV.s^{-1}$. *Bottom* Linear evolution with the scan rate of the cathodic and anodic peak currents related to the Ru^{III}/Ru^{II} couple.

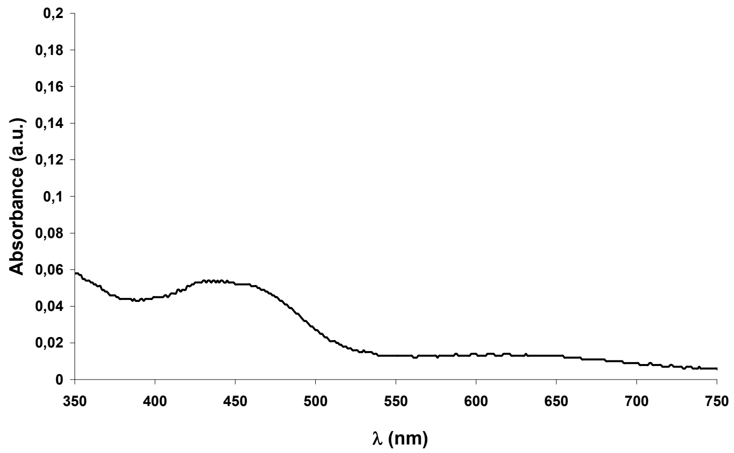


Figure S8. Absorption spectrum of complex **1** adsorbed on *templated nano-ITO* (10 layers, treated at 450°C for 1 hour in air), after substraction of the absorption of the non-functionalized *templated nano-ITO* film.

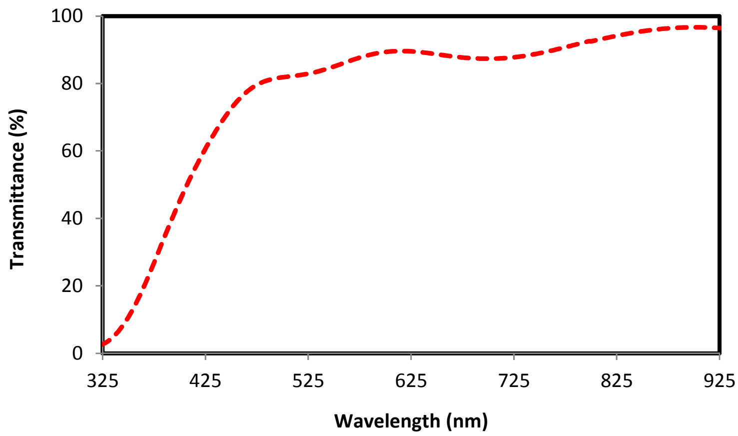


Figure S9. Transmittance for the 10−layers *dense nano−ITO* film heat−treated at 450°C for 1 h in air

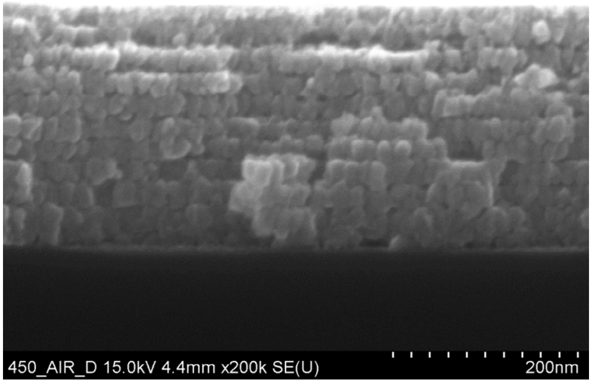


Figure S10. FE–SEM image (cross section view) of a 10 layers *dense nano-ITO* film treated at 450°C, in air.

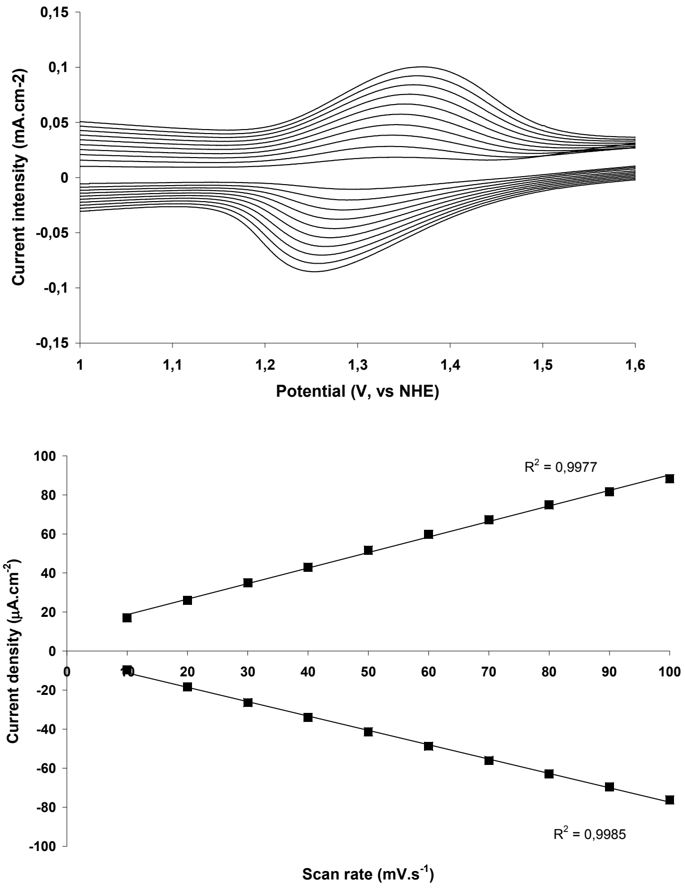


Figure S11. *Top* Cyclic voltammograms of complex **1** adsorbed on *dense nano-ITO* (10 layers prepared in the absence of template, treated at 450°C for 1 hour in air; electrode surface: 1 cm^2), recorded in 0.1M aqueous HOTf at scan rates varying from 10 to 100 $mV.s^{-1}$. *Bottom* Linear evolution with the scan rate of the cathodic and anodic peak currents related to the Ru^{III}/Ru^{II} couple.

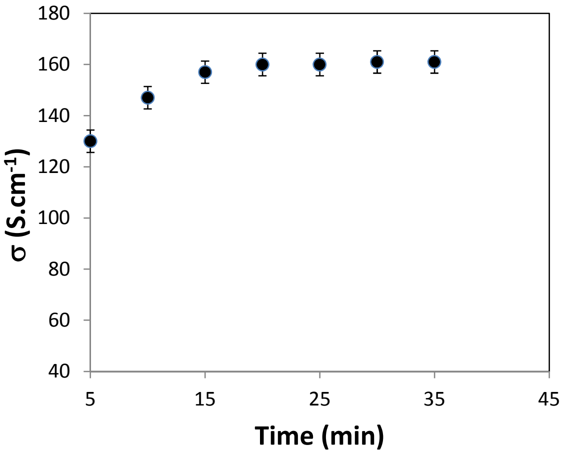


Figure S12. *In situ* electrical conductivity of films (thickness = 470 nm) heat-treated in air at 450°C: Evolution of the conductivity as a function of time for 10−layer *templated nano−ITO* films heated in 5% of H_2 in Ar at 200°C.

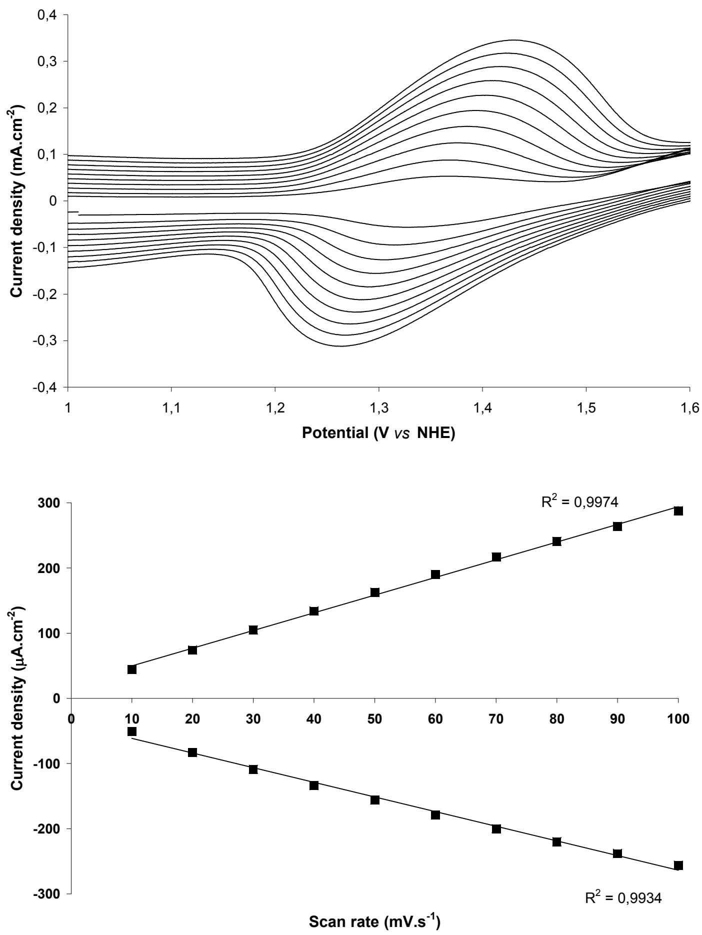


Figure S13. *Top* Cyclic voltammograms of complex **1** adsorbed on H_2-treated *templated nano-ITO* (10 layers, treated at 450°C for 1 hour in air then under 5% H_2 in Ar at 200°C for 30 min; electrode surface: 1 cm^2), recorded in 0.1M aqueous HOTf at scan rates varying from 10 to 100 $mV.s^{-1}$. *Bottom* Linear evolution with the scan rate of the cathodic and anodic peak currents related to the Ru^{III}/Ru^{II} couple.

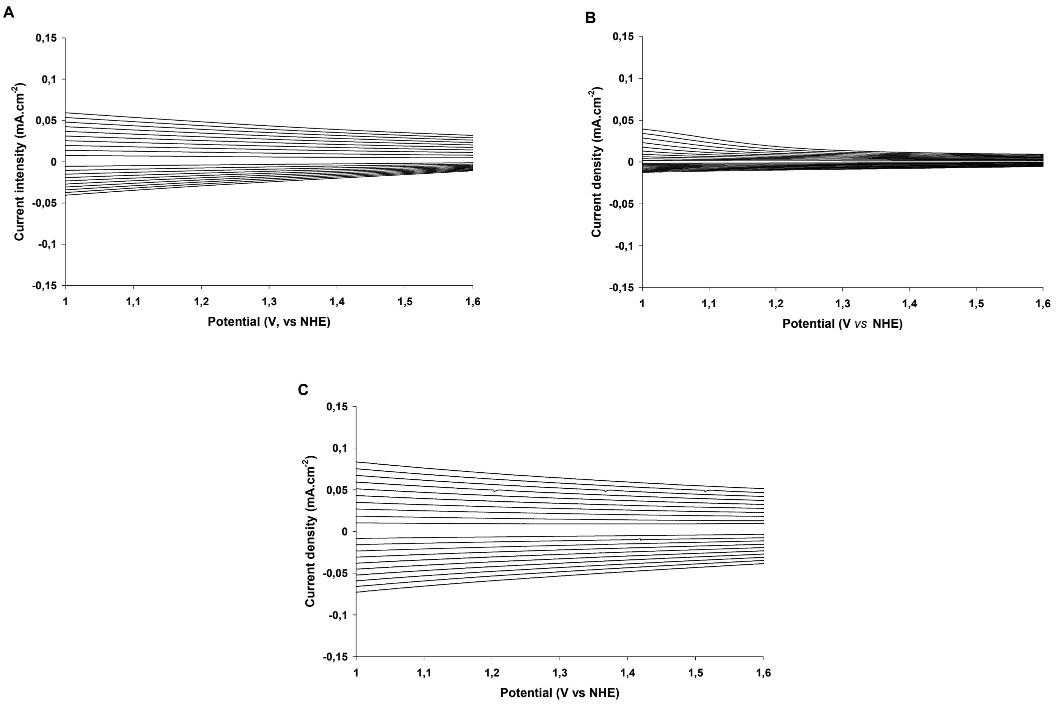


Figure S14. Sections of the cyclic voltammograms of non-functionalized **A**) 10-layer *templated nano-ITO*, **B**) 10-layer *dense nano-ITO*; **C**) 10 layers H_2-treated *templated nano-ITO*; recorded in 0.1M aqueous HOTf at scan rates varying from 10 to 100 $mV.s^{-1}$ (electrode surface: 1 cm^2).

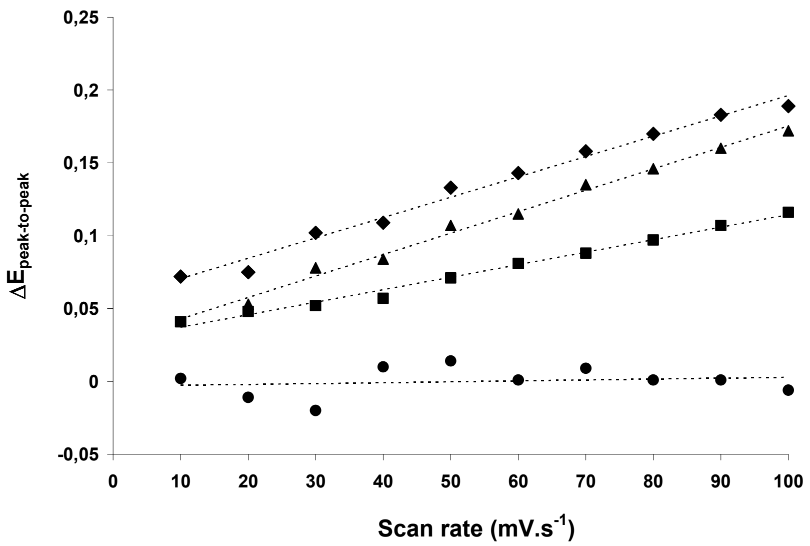


Figure S15. Peak−to−peak splitting between the oxidation and the reduction peak of complex **1** grafted on a 10−layer *templated nano−ITO* electrode (◆), a 10−layer H_2−treated *templated nano−ITO* electrode (▲), a 10−layer dense *nano−ITO* electrode (■) or a planar ITO electrode (●) (recorded in 0.1M aqueous HOTf at scan rates varying from 10 to 100 $mV.s^{-1}$).