Supplementary Information

Dye sensitised solar cells with nickel oxide photocathodes prepared via scalable microwave sintering

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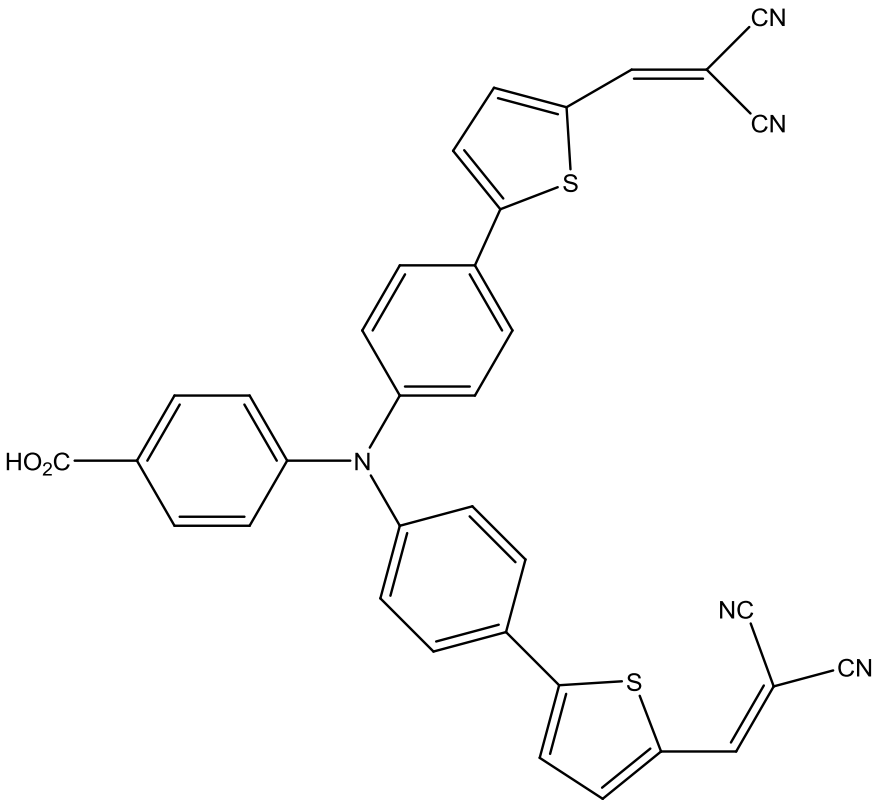

Figure SI0. Structure of the dye-sensitizer **P1**.

The redox properties of **P1** (Figure SI0) have been evaluated and the electrochemical data reproduce those reported in ref. 4b. The oxidation peaks of **P1** in solution at 0.7 and 1.3 V vs Fc+/Fc do not overlap with those of NiOx (range of electroactivity: 0-0.8 V vs Fc+/Fc). The details of the synthesis of P1 have been reported in ref. 4c. **P1** in acetontrile presents two main absorption peaks at 340 and 475 nm.

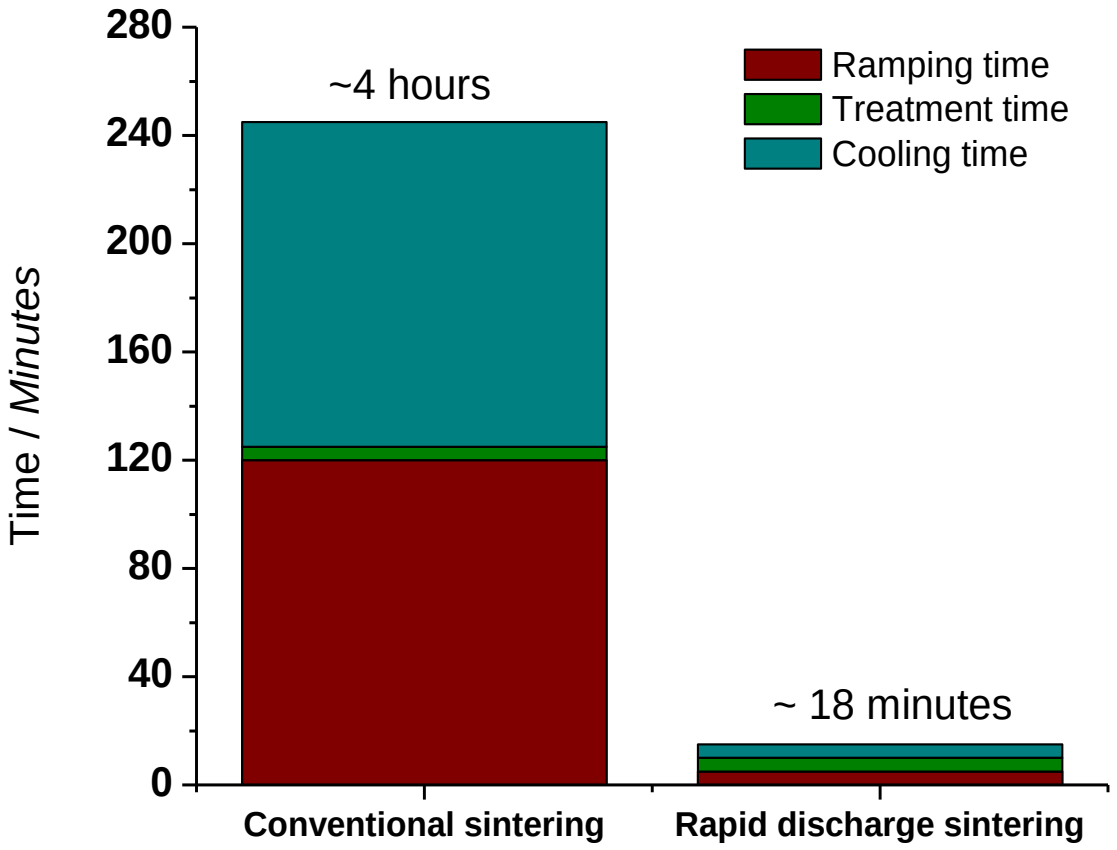

Figure SI1. Comparison of the processing times for CS and RDS sintering procedures when the deposition of NiO_x thin films for DSCs is considered.

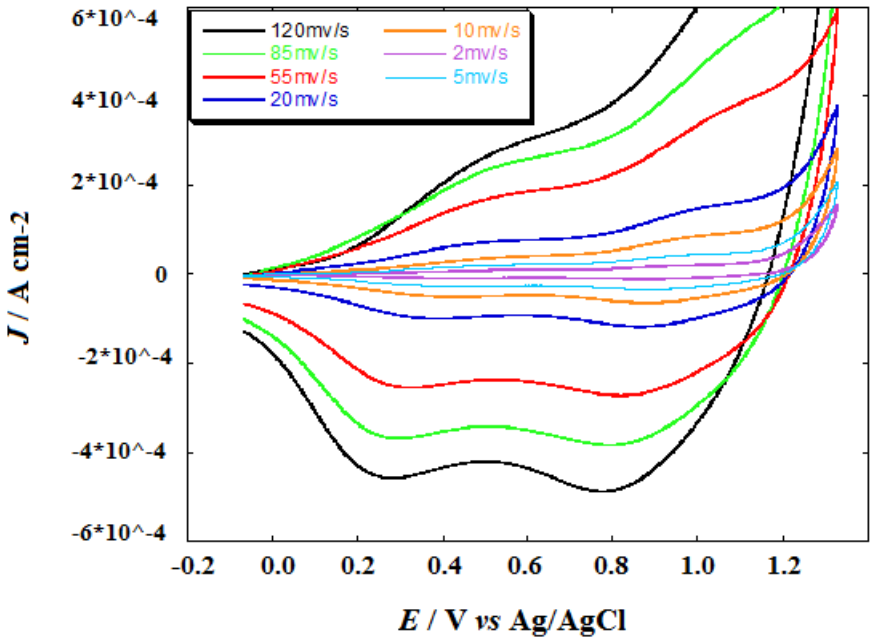

Figure SI2a. Voltammetric profiles of NiO sample **1** with thickness **a** (*l* : 0.4 μm) at different scan rates. Counter electrode: Pt; electrolyte composition: 0.2 M KCl, 0.01 M KH_2PO_4 and 0.01 M K_2HPO_4 in water.

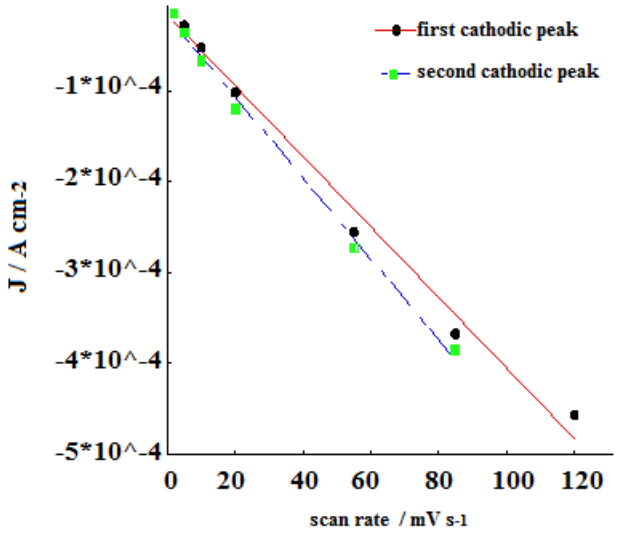

Figure SI2b. Linear scan rate dependence of the two cathodic peaks of NiO sample **1** with *l* : 0.4 μm from data of Figure SI2a. First and second cathodic peaks are centered at *ca.* 0.25 and 0.82 V *vs* Ag/AgCl, respectively.

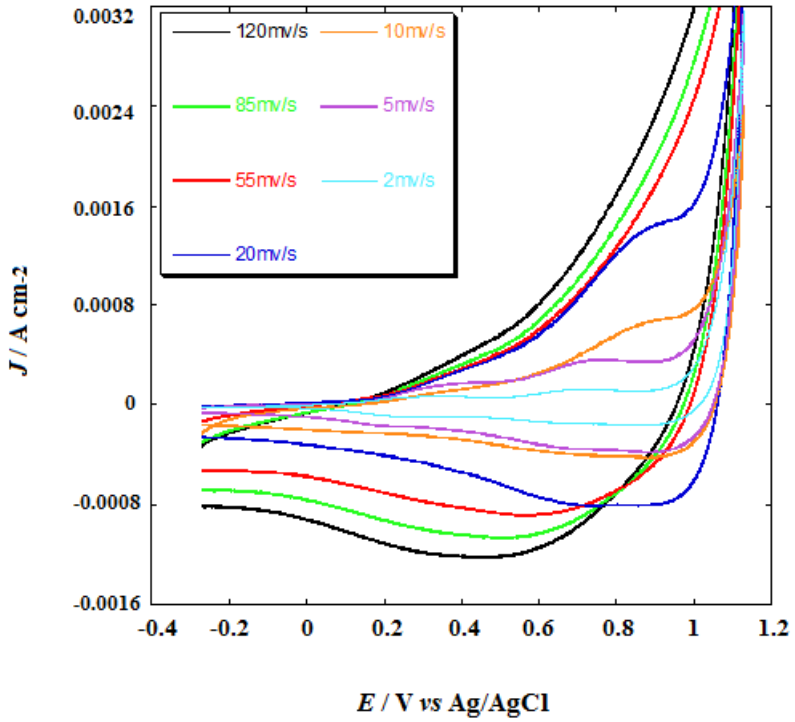

Figure SI3a. Voltammetric profiles of NiO sample **2** with thickness **a** (*l* : 0.4 μm) at different scan rates. Counter electrode: Pt; electrolyte composition: 0.2 M KCl, 0.01 M KH_2PO_4 and 0.01 M K_2HPO_4 in water.

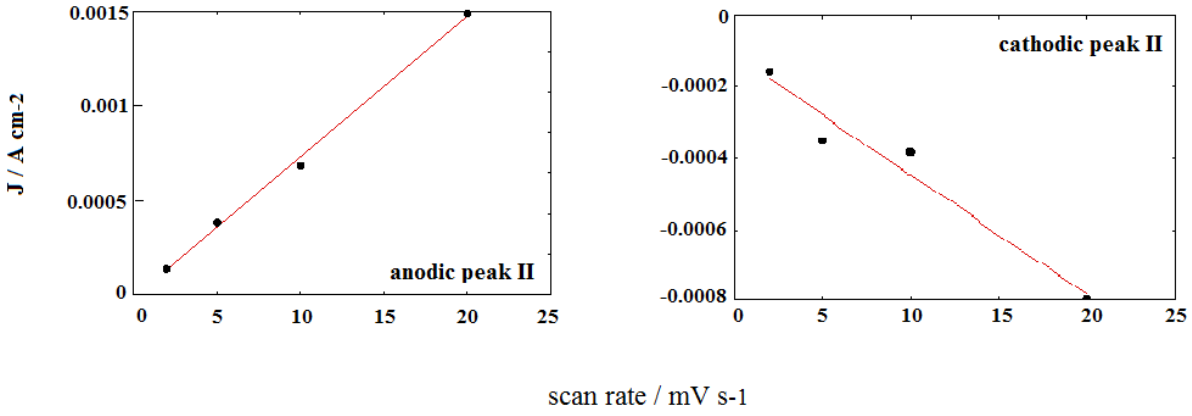

Figure SI3b. Linear scan rate dependence of (left) anodic and (right) cathodic peak II of NiO sample **2** with *l* : 0.4 μm (data from Figure SI3a). Peak II is centred at approximately 0.74 V *vs* Ag/AgCl.

The open circuit potential, V_{OC}, of the cell

$$FTO/NiO\ /Cl(0.2M)+KH_2PO_4(0.01M)+K_2HPO_4(0.01M)in\ H_2O\ /\ Pt$$

is reported in Table SI1. The striking difference between the V_{OC} value of the thinner films **a** and films **b** and **c** reflects the influence of the underlying FTO substrate in the determination of V_{OC} for samples **a**. These findings are coherent with the fact that FTO is not uniformly covered by the thinnest NiO film **a** when l : 0.4 μm, and the substrate gets in direct contact with the electrolyte.

When the ratio (γ) of oxidation peak I to oxidation peak II (Table SI1, data from Figure 4) is considered an empirical parameter indicative of the degree of crystallinity present in nanostructured NiO films [**5**] being $\gamma \geq 1$ in single crystals [**22b**], we find that the NiO films sintered with CS and RDS methods possess generally low crystallinity with γ ranging in the interval $0.6 < \gamma < 0.8$ for NiO samples **1** and **2**.

Sample	V_{OC} / V	$\gamma = J_p(I) / J_p(II)$
1a	-0.47	0.71
1b	0.33	0.67
1c	0.28	0.72
2a	-0.51	0.71
2b	0.29	0.63
2c	0.28	0.78

Table SI1. Open circuit voltage, V_{OC}, and ratio J_p(I) to J_p(II) (Table 2), γ, for bare NiO samples **1** and **2** with different thicknesses **a**-**c**. V_{OC} values are referred to the redox couple Ag/AgCl.

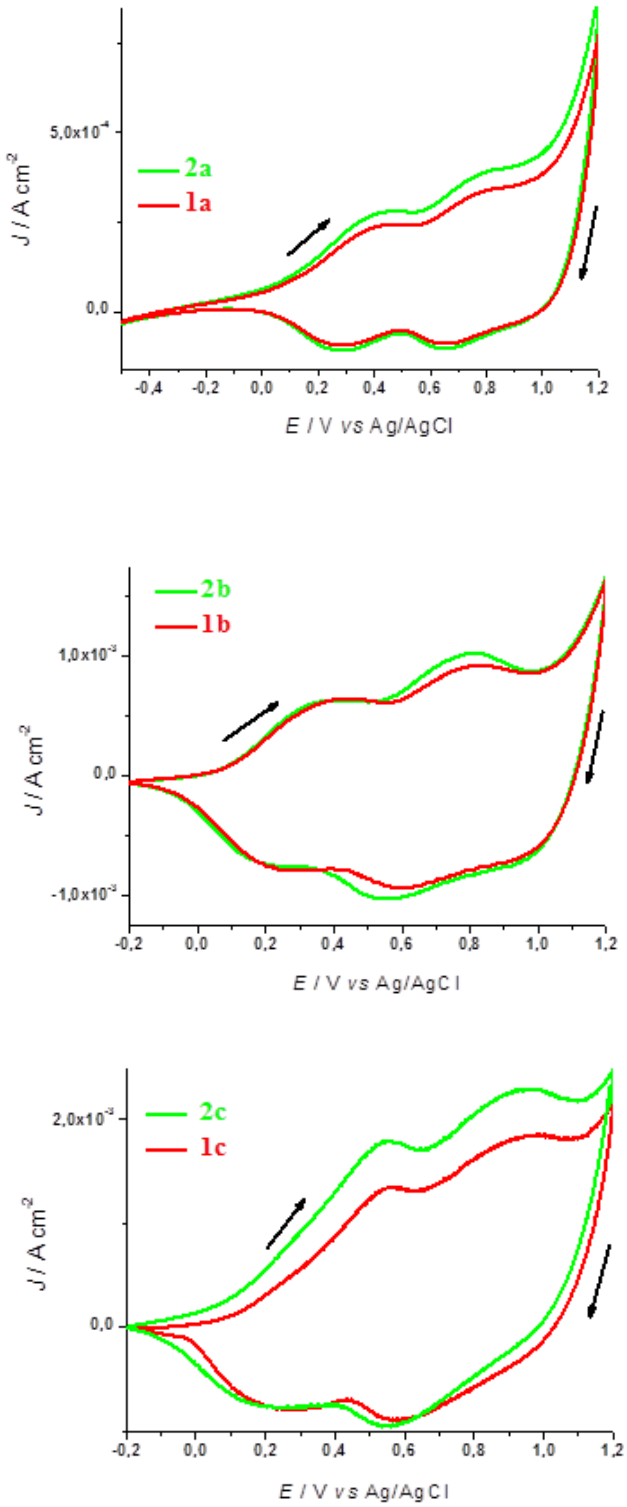

Figure SI4. Comparison of the cyclic voltammograms of NiO samples **1** and **2** having the same thickness. Data taken from Figure 4. Arrows indicate the direction of potential scan.

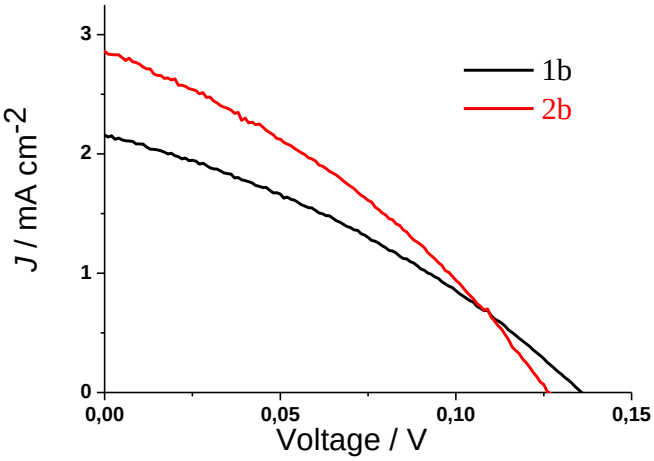

Figure SI5. *J-V* curves under illumination for *p*-DSCs assembled with NiO samples **1** and **2** having the same thickness **b**.

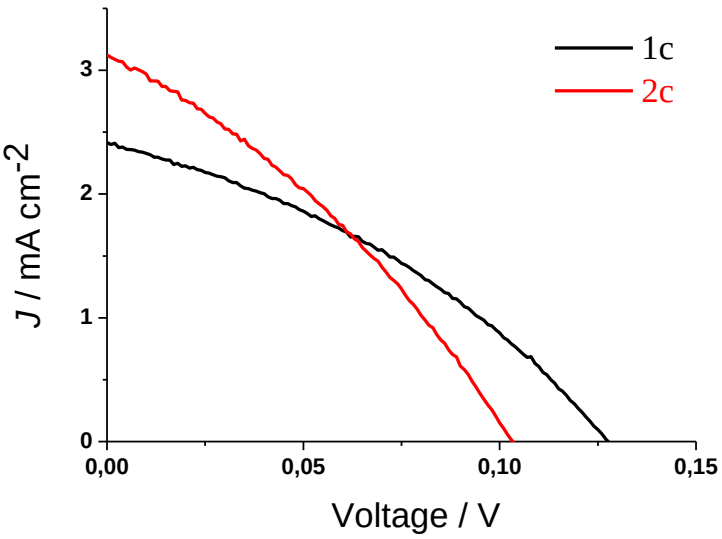

Figure SI6. *J-V* curves under illumination for *p*-DSCs assembled with NiO samples **1** and **2** having the same thickness **c**.

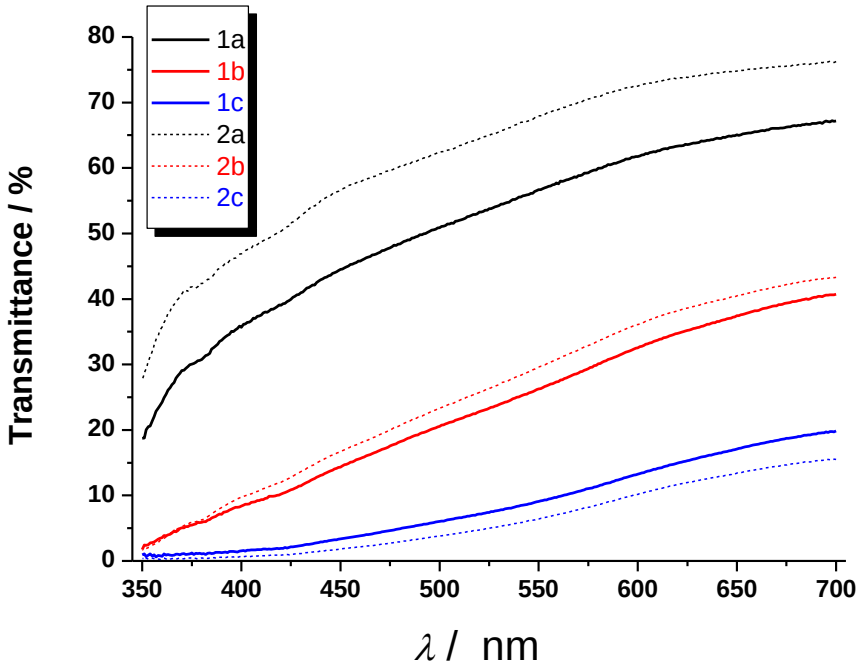

Figure SI7. Transmission spectra of bare NiO samples **1** and **2** at the three different thicknesses **a-c**. The generally higher transmittance of samples **2** in the thickness range $0.4 \leq l \leq 2.0$ μm is indicative of the lower density and reduced scattering phenomena in RDS samples **2** *vs* CS samples **1** as expected from the analysis of the morphological features (Figures 1 and 2).

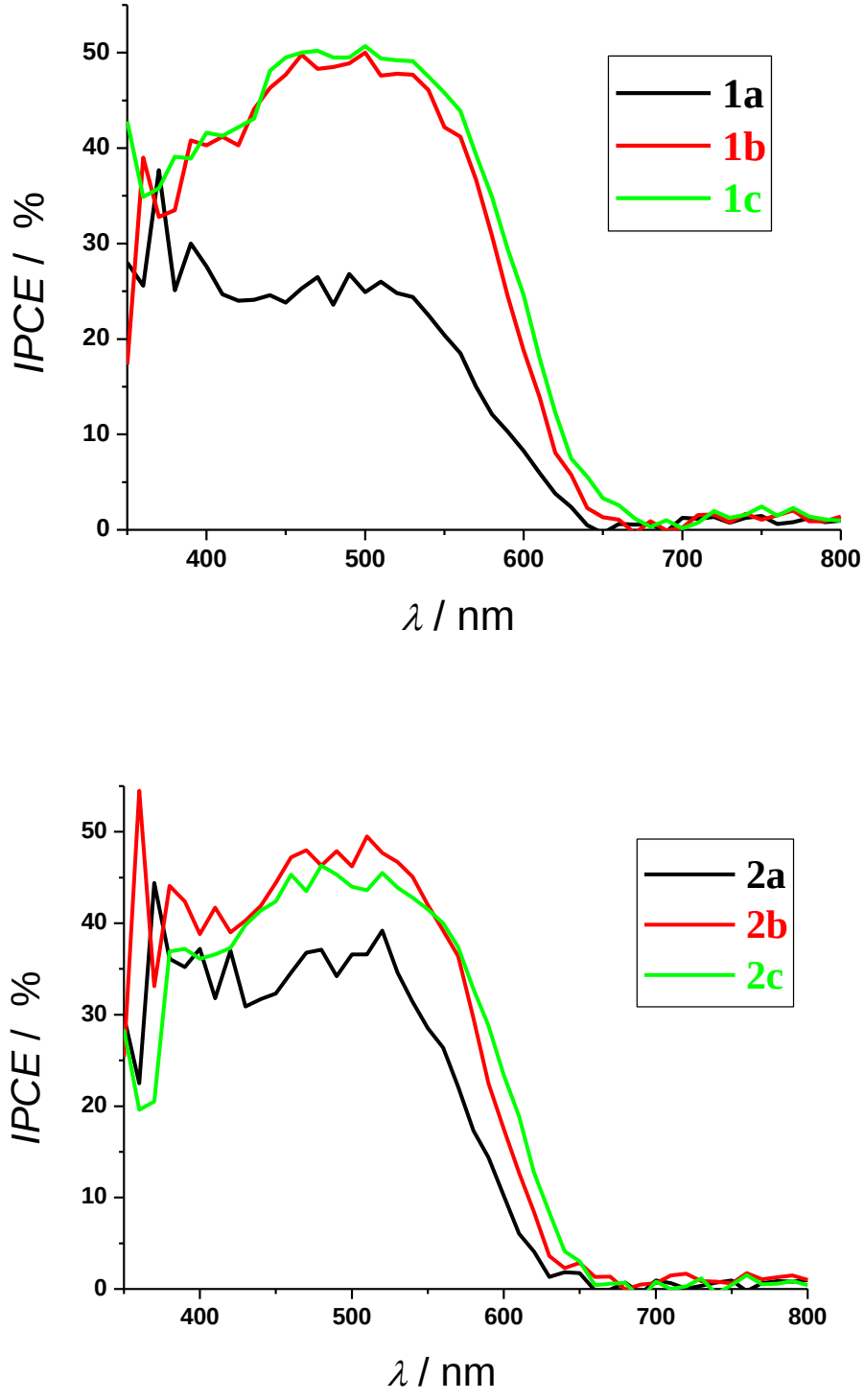

Figure SI8. *IPCE* spectra of P1-sensitized NiO samples **1** (upper graph) and **2** (lower graph) at the three different thicknesses **a-c**.

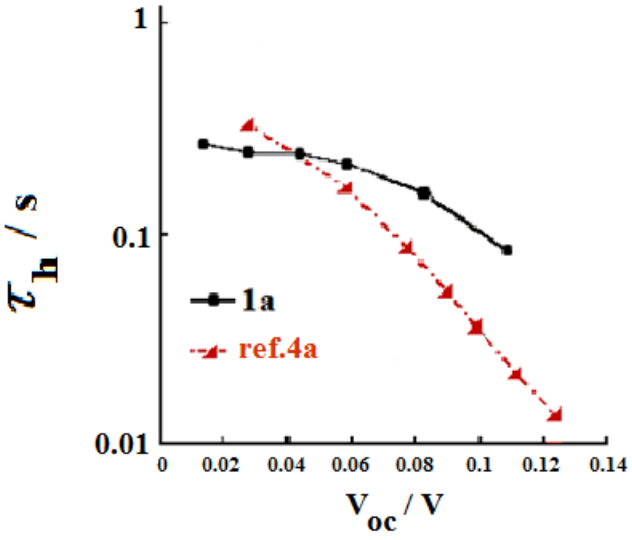

Figure SI9. Hole lifetime (τ_h) *vs* open circuit photovoltage V_{OC} plot for a *p*-DSC assembled with NiO sample **1a** sensitized with P1, and data from ref.4a referring to a sample with comparable thickness.