

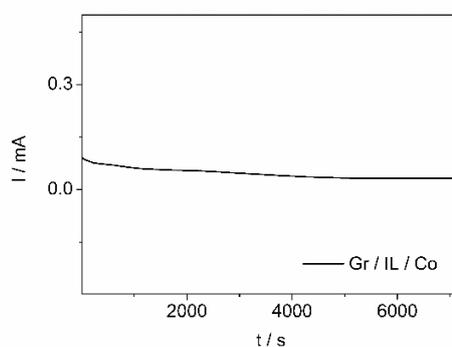
## SUPPLEMENTARY MATERIALS

**Table S1.** Parameters obtained for the electrodic systems towards HER.  $R_s$  is the solution resistance,  $R_{ct}$  is the charge transfer resistance,  $L$  is inductance and CPE is the constant phase element.

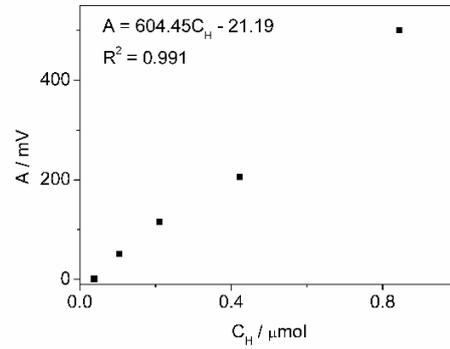
System	$R_s$	$R_{ct}$	$L$	CPE-T	CPE-P
Gr	305	3950	1	$2 \cdot 10^{-3}$	0.60
Gr/Co	340	1010	1	$1 \cdot 10^{-3}$	0.70
Gr/IL	310	1510	1	$2 \cdot 10^{-3}$	0.60
Gr/IL/Co	350	960	1	$2 \cdot 10^{-4}$	0.65
Gr/IL/Co 395 nm	360	545	1	$1 \cdot 10^{-3}$	0.45

**Table S2.** Wavelength ( $\lambda$ ) and intensity of the lamps used in the study.

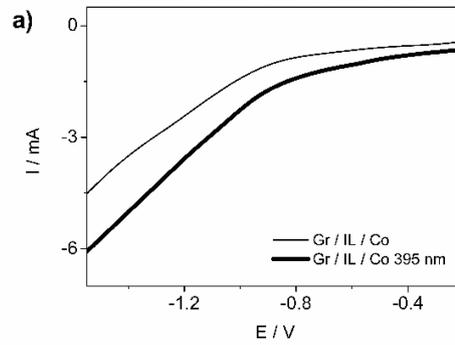
Lamp / n°	$\lambda$ / nm	Intensity / $W \cdot m^{-2}$
1	380	150
2	395	800
3	420	250
4	495	350
5	520	150
6	560	200
7	610	50
8	620	150
9	660	650



**Figure S1.** Study of current stability in electrolysis time at -1.3 V, for 2 hours for the system Gr/IL/Co. Phosphate buffer at pH = 7.



**Figure S2.** Linear relation between area and hydrogen concentration obtained by gas chromatography using extra pure hydrogen (99.999%).



**Figure S3.** Voltammetric profile of the Gr/IL/Co and Gr/IL/Co 395 nm systems used in the chromatographic determination. Phosphate buffer at pH = 7 in Ar saturation.  $v = 0.1 \text{ V}\cdot\text{s}^{-1}$ .