Supplemental Material

Ionic liquids to monitor the nano-structuration and the surface functionalization of material electrodes: a proof of concept applied to cobalt oxyhydroxide

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Supplementary Information

S1. Representation of the ionic liquids and localization of the Carbon “C2” with an acidic hydrogen

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\text{PMIMBr} \quad \text{EMIMBF}_4
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S2. Evolution of weight vs temperature during thermogravimetric analyses (TGA) of HCoO$_2$, HCoO$_2$-EMIMBF$_4$, HCoO$_2$-PMIMBr and of the pure ionic liquids for comparison sake.

The TGA analyses show that the weight loss is calculated to be $\sim 21\%$ for HCoO$_2$-EMIMBF$_4$ and HCoO$_2$-PMIMBr, and $20\%$ for HCoO$_2$ at 700°C. This result reveals that the quantity of ionic liquid is very low, as expected with a surface functionalization.

S3. Cyclic voltammetry curves of HCoO$_2$ in 5M-KOH at 5 mV/s

For HCoO$_2$ electrode material, the second oxidation peak relative to the Co(III)/Co(IV) redox couple is centered around 0.51 V and is overlapped with the oxygen evolution peak.
S4. Equivalent circuit used for the fitting of the EIS data

$R_1$ represents the bulk solution resistance, $R_2$ represents the faradic charge transfer resistance across the electrode/electrolyte interface, $W_2$ the Warburg element and $C_2$ a capacitor whereas a double layer capacitance $Q_2$ (Constant Phase Element) is connected parallel with $R_2$. 
S5. Cyclic voltammetry curves at different scan rates: 
a) HCoO$_2$ in 5M-KOH 
b) HCoO$_2$ in 0.5M-K$_2$SO$_4$

a) HCoO$_2$-EMIMBF$_4$ in 5M-KOH 
b) HCoO$_2$-EMIMBF$_4$ in 0.5M-K$_2$SO$_4$

c) HCoO$_2$-PMIMBr in 5M-KOH 
d) HCoO$_2$-PMIMBr in 0.5M-K$_2$SO$_4$