

## Supporting Information

Post-Overoxidation Self-Recovery of Polypyrrole Doped with a  
Metallacarborane Anion

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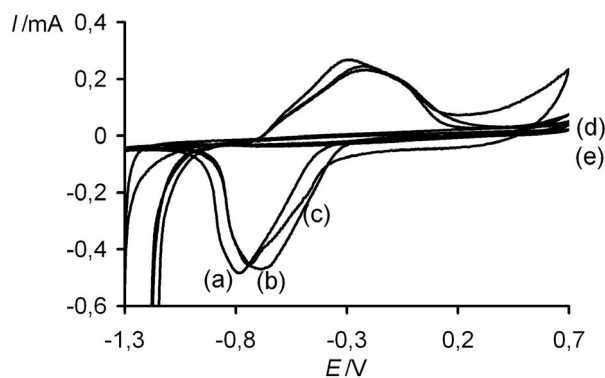
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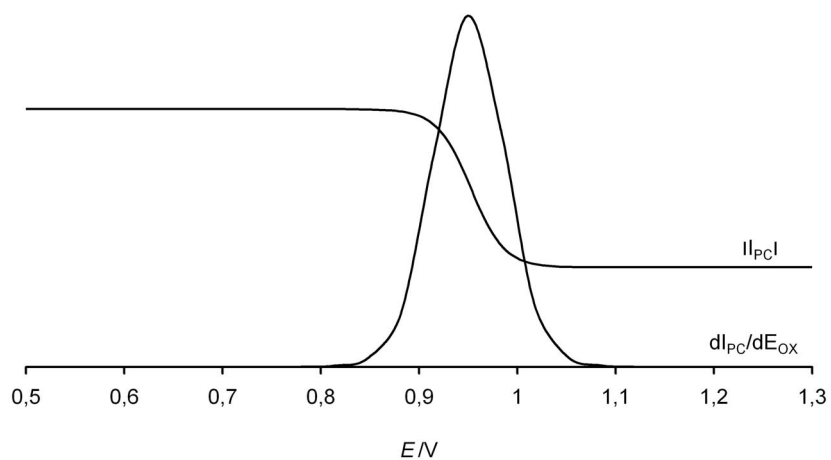
**Tests to quantify and correlate the Overoxidation Resistance Limit (ORL) of the different PPy doped materials:**

- **PPy/[DBS]**

**Figure S1.** PPy/[DBS] ion exchange voltammograms in NaCl 0.1 M after oxidation at Eox: a) 500, b) 900, c) 700, d) 1100 mV and e) 1300 mV.



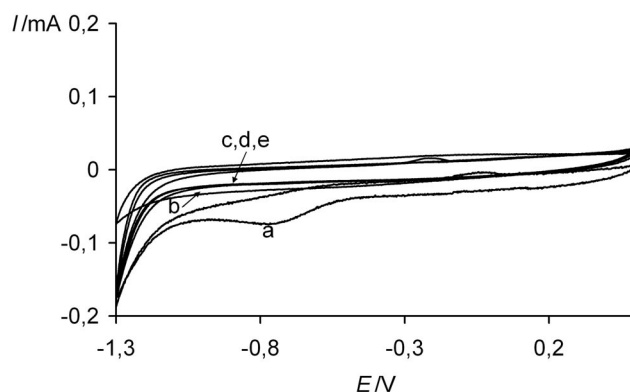
**Figure S2.** Sigmoidal curve for PPy/[DBS] obtained from the cathodic intensity maxima ( $|I_{P,C}|$ ) plotted vs the  $E_{OX}$  stimulus, and the  $dI_{P,C}/dE_{OX}$  plotted vs  $E_{OX}$ . A well defined maximum is obtained with this method enabling to calculate Ppy/[DBS]'s ORL as 950 mV. This value is near the 990 mV obtained with the LSV.



### Self-repair capacity:

- **PPy/[1]**

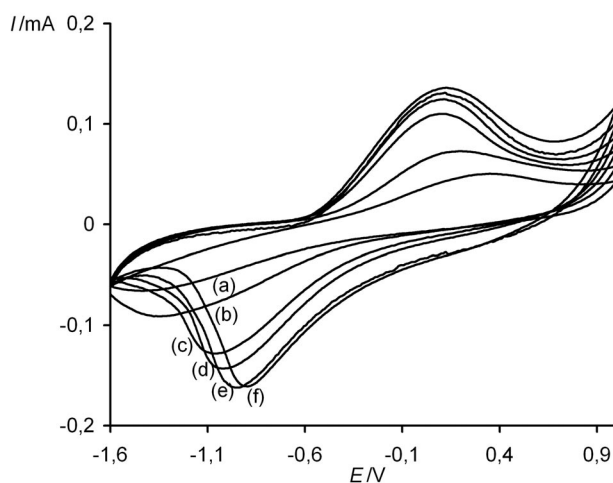
**Figure S3.** Ion exchange tests in NaCl 0.1 M of a PPy/[1] material: a) immediately after the oxidation at a potential above its ORL (1250 mV), 1400 mV; and after b) 1, c) 2, d) 3 and e) 18 hours immersed in NaCl 0.1 M.



This material does not show the self-repair property, so the covalent grafting of the doping anion [1]<sup>-</sup> to PPy strands is one of the necessary conditions for the self-repair capacity.

- **PPy-[1sp']**

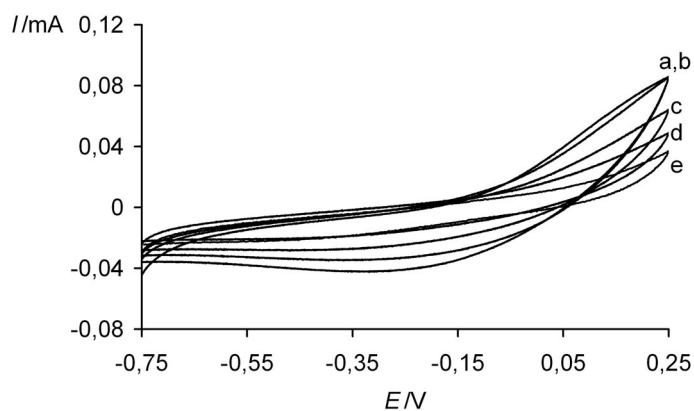
**Figure S4.** Gradual activity recovery of PPy-[1sp'] shown by ion exchange tests in NaCl 0.1 M: a) immediately after the insult of PPy-[1sp'] at 1350 mV, and after b) 1, c) 3, d) 4, e) 5 and f) 20 hours immersed in NaCl 0.1 M.



The behaviour of PPy-[1sp'] is parallel to PPy-[1sp].

- **PPy-(CH<sub>2</sub>)<sub>3</sub>SO<sub>3</sub>**

**Figure S5.** Ion exchange tests in NaCl 0.1 M of a PPy-(CH<sub>2</sub>)<sub>3</sub>SO<sub>3</sub> material: a) immediately after oxidation at a potential above its ORL (800 mV), 900 mV; and after b) 1, c) 2, d) 3 and e) 18 hours immersed in NaCl 0.1 M.



This material does not show the self-repair property, so the properties of the doping anions are other important condition for the self-repair capacity.