Electronic Supplementary information

Magnetic field-enhanced redox chemistry on-the-fly for enantioselective synthesis

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Content

Additional experimental section

Enantiomeric excess

The enantiomeric excess (%ee) was calculated by using equation (1):

$$Enantiomeric\ Excess\ (\%\ ee) = \left[\frac{(R)PE - (S)PE}{(R)PE + (S)PE}\right] x\ 100 \quad (1)$$

where (R)-1-PE and (S)-1-PE represent the corresponding integrated HPLC peak areas.

Product yield and conversion values

The product yield (% PY) of each compound present in the sample was evaluated by the ratio between the integrated HPLC peak area of each enantiomer and the sum of the integrated HPLC peak areas of the precursor and of the two enantiomers (Equation 2 and 3).

$$\%\ PY_{\ (R)enantiomer} = \frac{Area\ of\ (R)enantiomer}{Total\ Area}\ x\ 100 \quad (2)$$

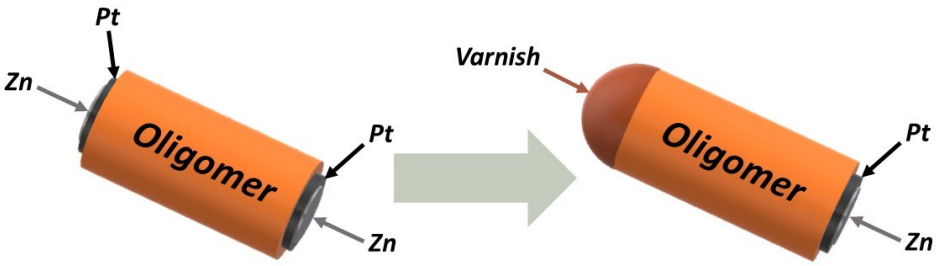
$$\%\ PY_{(S)enantiomer} = \frac{Area\ of\ (S)enantiomer}{Total\ Area}\ x\ 100 \quad (3)$$

In this work we have used these equations to calculate the PY, because AP and PE have almost the same molar extinction coefficient (ε_{AP} = 12 $mM^{-1}cm^{-1}$, $\varepsilon_{1\text{-}PE}$ = 11.9 $mM^{-1}cm^{-1}$, respectively).

Since in all the experiments, the initial amount of precursor was 2.5 mmol ($n_{precursor}$) and the reaction time was 1 hour (t), the conversion rate of the reaction was calculated according to equation (4):

$$Coversion\ rate = \frac{n_{precursor}\ x\ \%\ PY_{(S)\ or\ (R)enantiomer}}{t\ x\ 100\ x\ 6\ x\ l} \quad (4)$$

It is important to highlight that in equation 4 the conversion rate was normalized with respect to the total length of the six swimmers used for each electroconversion (*l* = 1.1 mm ± 0.2 mm)



Scheme S1. Schematic illustration of the double-faced Zn swimmer before (left) and after protecting one face with varnish (right).

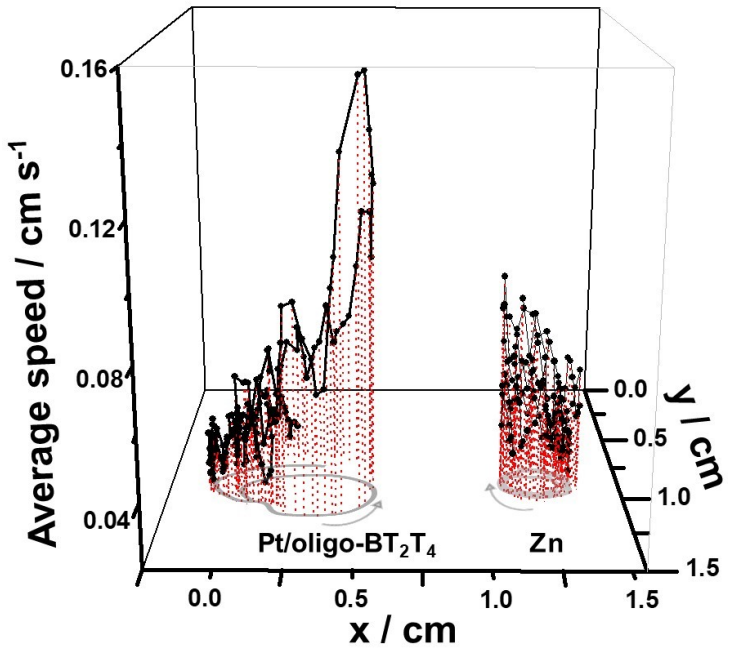


Fig. S1 Speed profile as a function of the position of a glassy carbon tracer bead (Ø = 500 – 1000 µm) moving at the air/water interface (0.1 M H_2SO_4 and 50 mM AP) above two different regions of the macroscopic Zn/Pt/oligo-BT_2T_4 wire (indicated in the figure) in the presence of the magnetic field (north pole upwards).

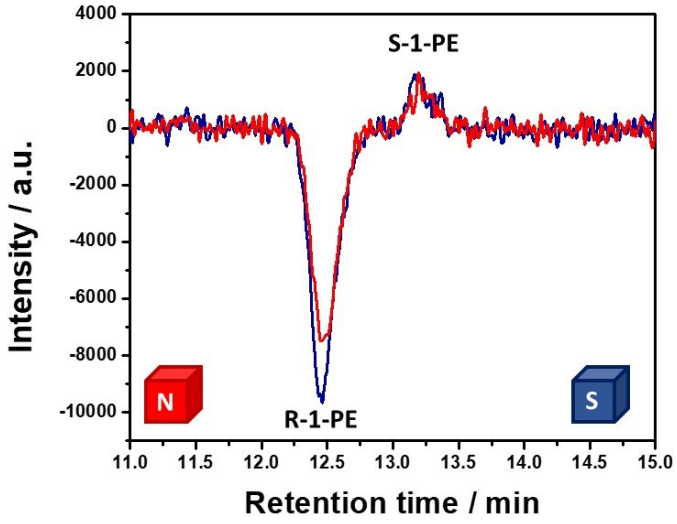


Fig. S2 Chromatogram with online CD detection for the product solution obtained after 1 hour of asymmetric synthesis carried out by the continuous displacement of 6 Zn/Pt/oligo-(R)-BT_2T_4 swimmers placed at the air/water interface of a 0.1 M H_2SO_4 and 50 mM AP solution, as function of the magnetic field orientation (indicated in the figure)

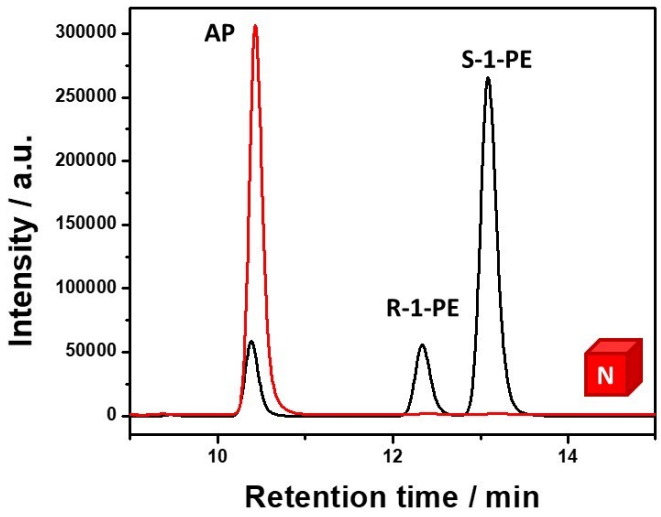


Fig. S3 Chromatograms of the product mixtures obtained after 1 hour of synthesis, carried out by 6 chiral Zn/Pt/oligo-(S)-BT_2T_4 (black line) or 6 achiral Zn/Pt swimmers (red line), placed at the air/water interface of a 0.1 M H_2SO_4 and 50 mM AP solution, in the presence of an orthogonal magnetic field (north pole upward)

Video S1 Tracer particles around a macroscopic hybrid wire in the absence and presence of a magnetic field (x5)

Video S2 Zoom on an individual hybrid Janus swimmer (Zn/Pt/oligo-(R)-BT_2T_4) exposed to either the magnetic north or south pole (x25)

Video S3 Large scale visualization of the dynamics of 6 Janus swimmers exposed to the magnetic south pole (x25)

Video S4 Zoom on an individual hybrid Janus swimmer (Zn/Pt/oligo-(S)-BT_2T_4) in the absence and presence of a magnetic field (x25)

Video S5 Zoom on an achiral Zn/Pt swimmer in the presence of a magnetic field (x25)