**Supplementary information**

# Chip-Based 3D Chiral Metamaterial with Functional Core-Shell Architecture for Femtomolar Biodetection

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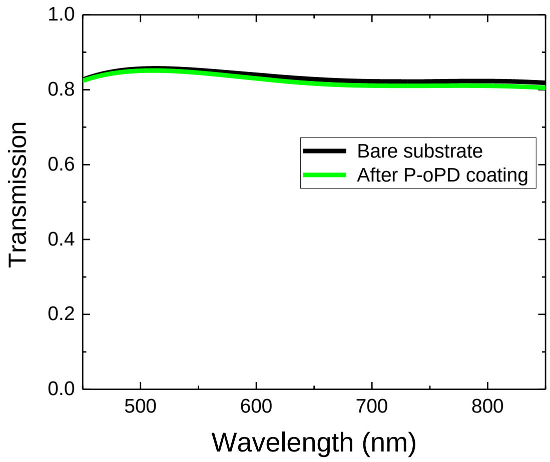


Figure S1. Transmission spectra of the ITO substrate before and after the shell coating.

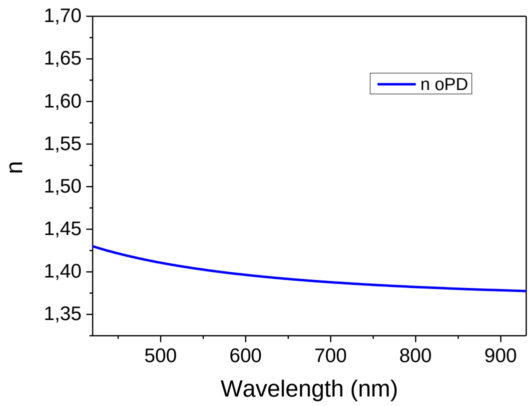


Figure S2. Retrieved refractive index of P-oPD deposited at the same conditions used for depositing the polymeric shell around the helix on an ITO substrate.

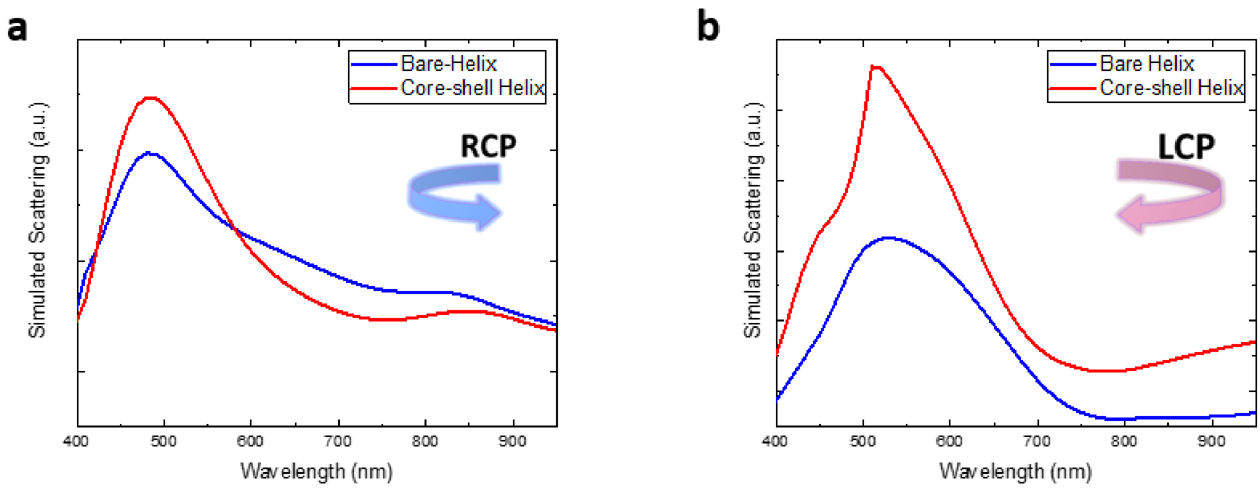


Figure S3. Simulated scattering spectra for a single bare helix (blue line) and core-shell helix (red line) for both circular polarization handedness: RCP (a) and LCP (b), respectively.

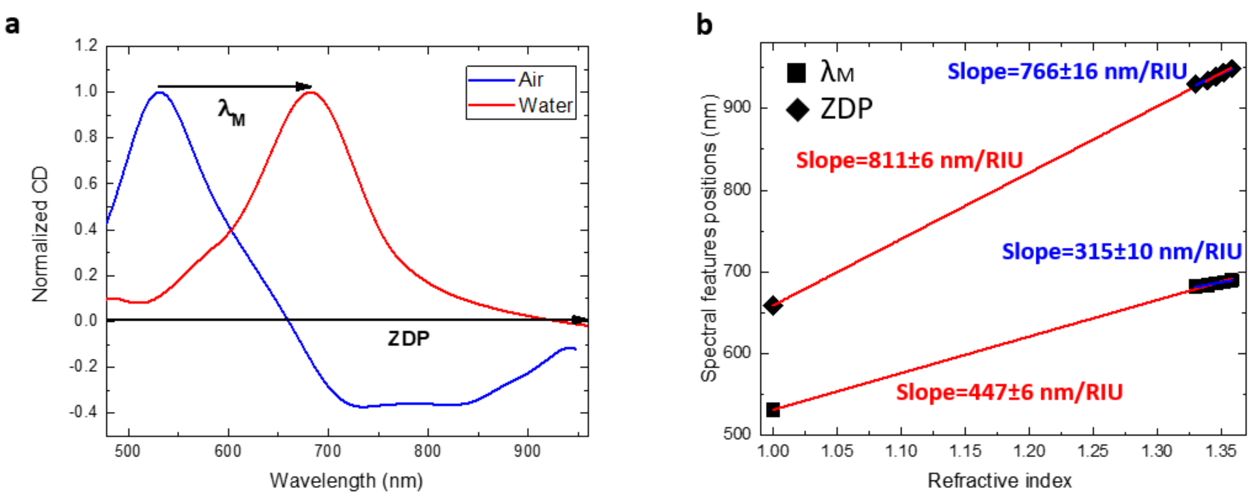


Figure S4. a) CD spectra of the measured core-shell nano-helices arrays in air (blue line) and water (red line). The large redshift is related to the RI of the different environment: air n=1 and water n=1.334. b) Trends of the spectral positions of $\lambda_M$ (Black square) and ZDP (black rhombs) measured in air and by varying glycerol-water solutions at different concentration corresponding to different RI variations from n=1.333 (100% water, 0% glycerol) to n=1.346 (80% water, 20% glycerol). The red lines correspond to their respective calculated linear fitting. Particularly the linear fitting of the points calculated in the refractive index range from n=1.333 to n=1.346 (blue line) gives rise to an slope of 315 nm/RIU for $\lambda_M$ and 766 nm/RIU for ZDP. The slope obtained from the linear fitting in the RI range from n=1 to n=1.346 (red line) gave instead values of 447nm/RIU and 811 nm/RIU for $\lambda_M$ and ZDP, respectively. The slope values retrieved are comparable with and without considering their spectral position measured in air environment. Therefore, the entire spectral range can be well fitted linearly [1–3].

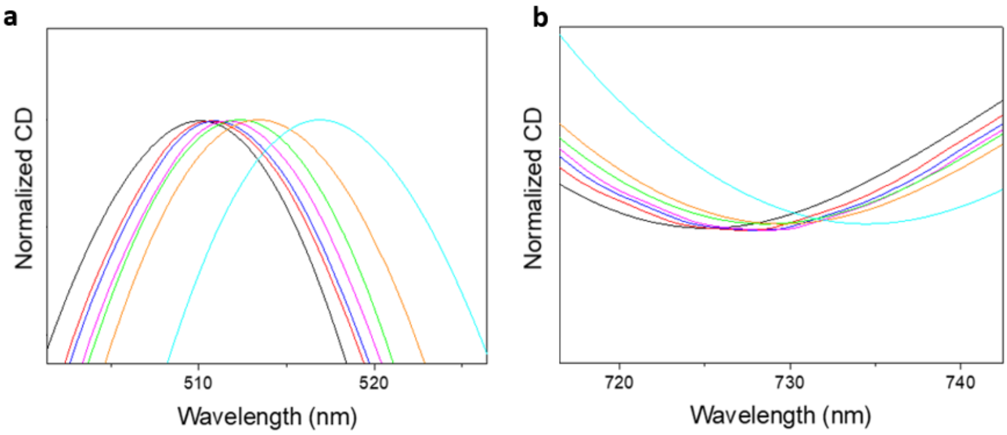


Figure S5. Detailed plots of the resonance shifts of the CD at $\lambda_M$ (a) and $\lambda_m$ (b), respectively.

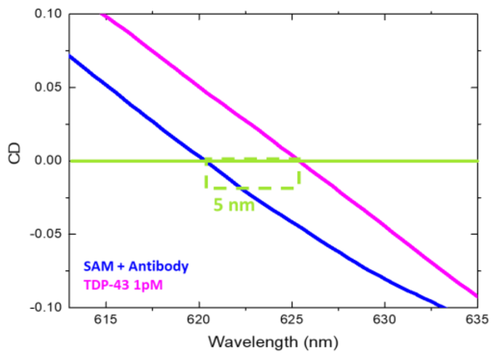


Figure S6. Shift of the crossing point between antibody and the antigen acquired by performing a previous functionalization with SAM technique. As one can observe, the redshift is less than 5 times smaller than the system we developed.


1. Shen, Y. *et al.* Plasmonic gold mushroom arrays with refractive index sensing figures of merit approaching the theoretical limit. *Nat. Commun.* **4**, 2381 (2013).

2. Hernández, A. L. *et al.* How the surrounding environment affects the biosensing performance of resonant nanopillars arrays: Under dry conditions or immersed in fluid. *Sensors Actuators B Chem.* **259**, 956–962 (2018).

3. Yesilkoy, F. *et al.* Phase-sensitive plasmonic biosensor using a portable and large field-of-view interferometric microarray imager. *Light Sci. Appl.* **7**, 17152 (2018).