Electronic Supplementary Material (ESI) for RSC Advances.

Photonic post-processing of a multi-material transparent conductive electrode architecture for optoelectronic device integration

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SUPPLEMENTARY INFORMATION

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Siver nanowires embedding, and surface modification, on the PET substrate as a result of the photonic sintering processing

The results presented in Figure S1 corroborate the SEM observations in Figure 3, showing that the PET surface was locally affected by the heated nanowires, which in this case, is represented by the dark colored pits in both AFM images. The surface variations between the pits and the surrounding high areas are the result of excess heat generated at the nanowires.

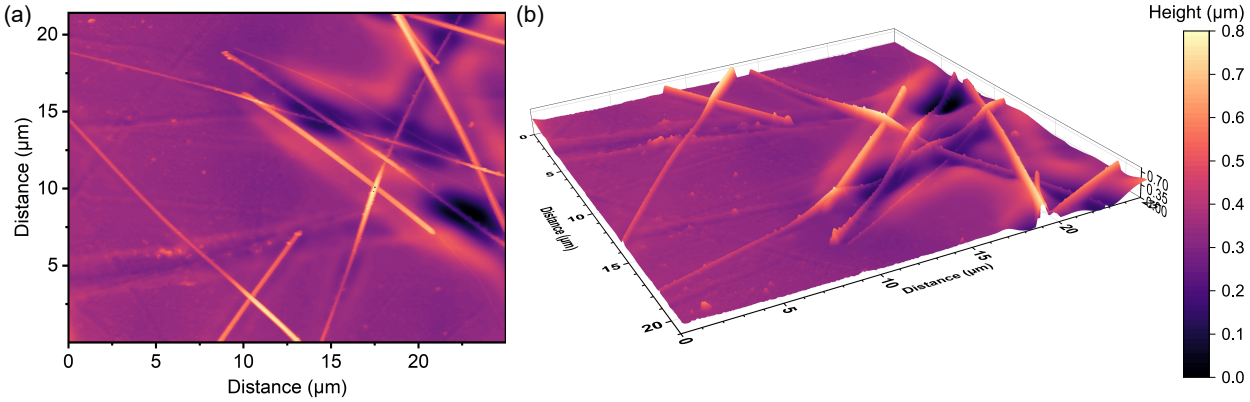

Fig. S1 AFM topographic reconstruction of the AgNWs AfterPC. Both (a) 2D reconstruction and (b) 3D projection show how the nanowires penetrated the PET substrate locally affecting it's structure.

EDS analysis report of the hybrid TCE architecture

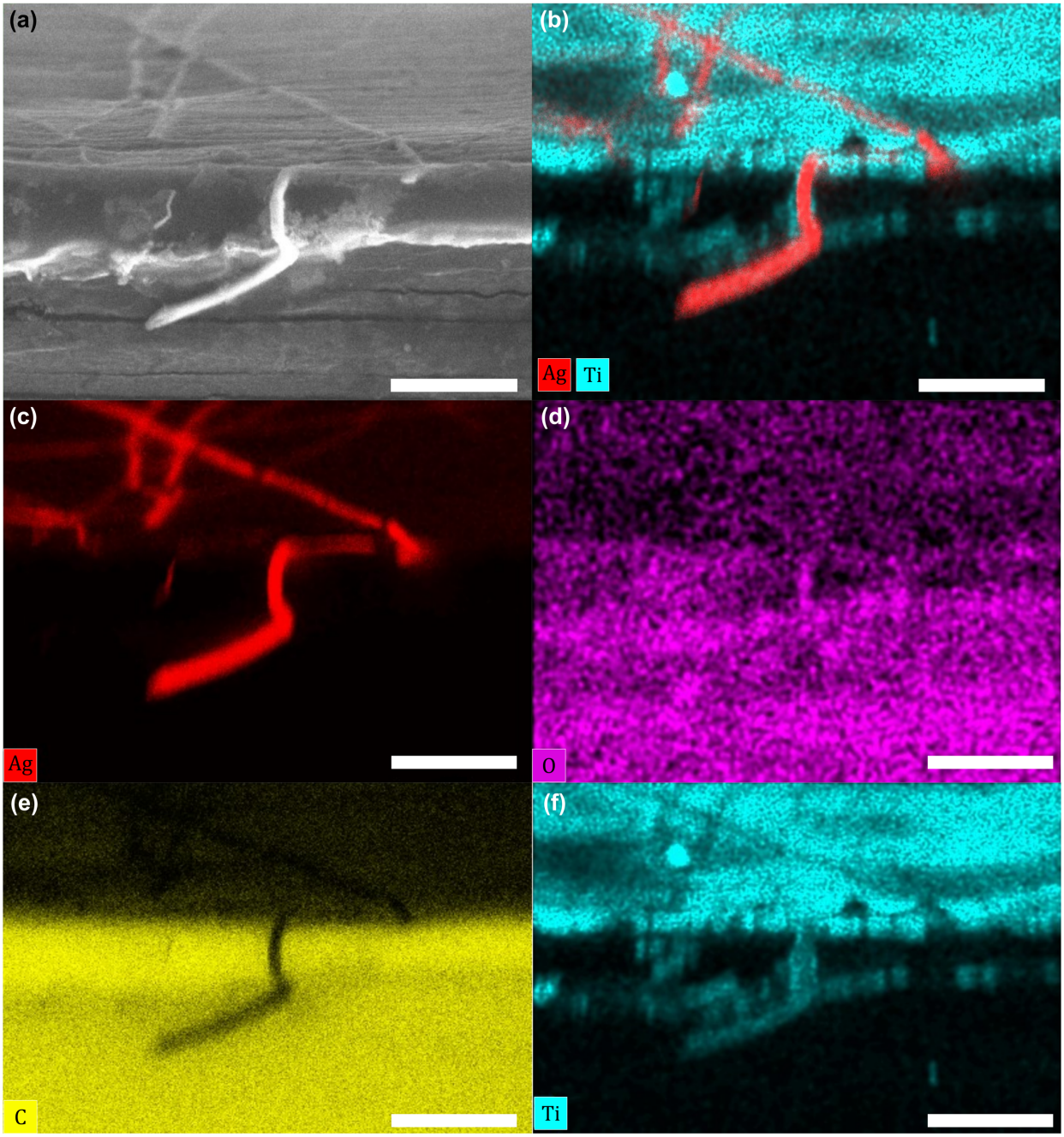

Fig. S2 EDS analysis of a cross sectional cut of a film of AgNWs covered in TiO_2. (a) Initial SEM image. (b) Composite image of detected Ag and Ti elements. (c) Silver only highlighting the distribution of the nanowires in the matrix. (d) Oxygen only image, which is present in both the substrate and the covering layer. (e) Carbon only image that is mostly present in the substrate. (f) Titanium only which corresponds to the coverage film atop the nanowires. Based on (a) and (b) the TiO_2 layer was estimated to be 400nm in thickness. All scale-bars correspond to 2 µm in length.

Crystallinity analysis the TiO_2 precursor by XRD

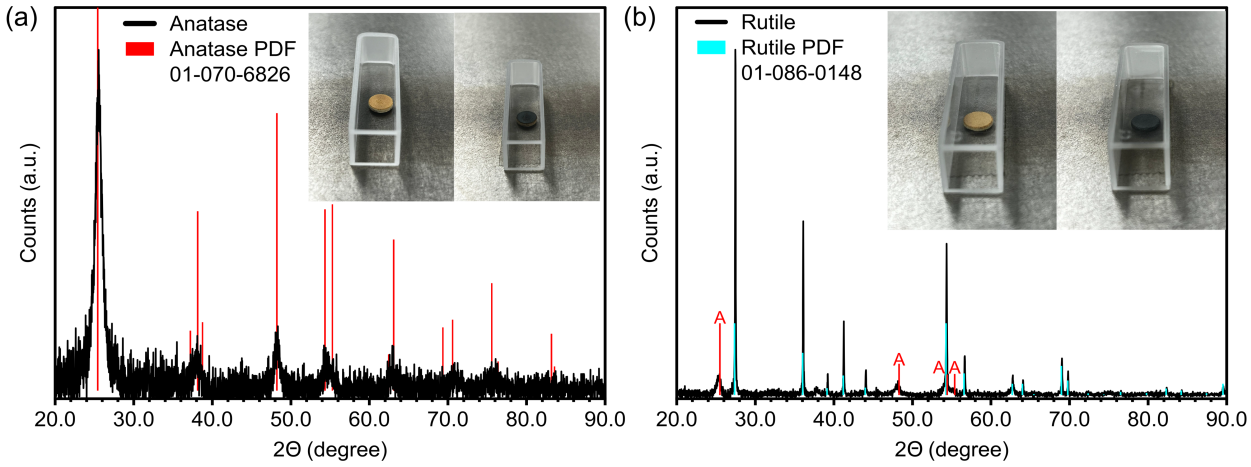

Fig. S3 XRD of pellets made of the same TiO_2 precursor, dried in powder form. These pellets are subject to photonic crystallization to obtain anatase phase in (a) and rutile phase in (b). Four peaks coming from anatase are detectable when analysing the rutile pellet in (b), this is a by-product of the rutile photonic crystallization processing on thicker samples. The inset pictures in both figures show the pellets before and after photonic crystallization.

Method for measuring of haze in nanowire-based semitransparent films

Using a UV/VIS spectrometer and an integrating sphere, following the relation H = (T4/T2-T3/T1)·100%, where T2 and T4 are the sample's total transmittance and forward scattered light, and T1 and T3 represent the correction factor from the equipment using the white standard and the open-ended sphere, respectively [1,2]. The general scheme is depicted in Figure S2.

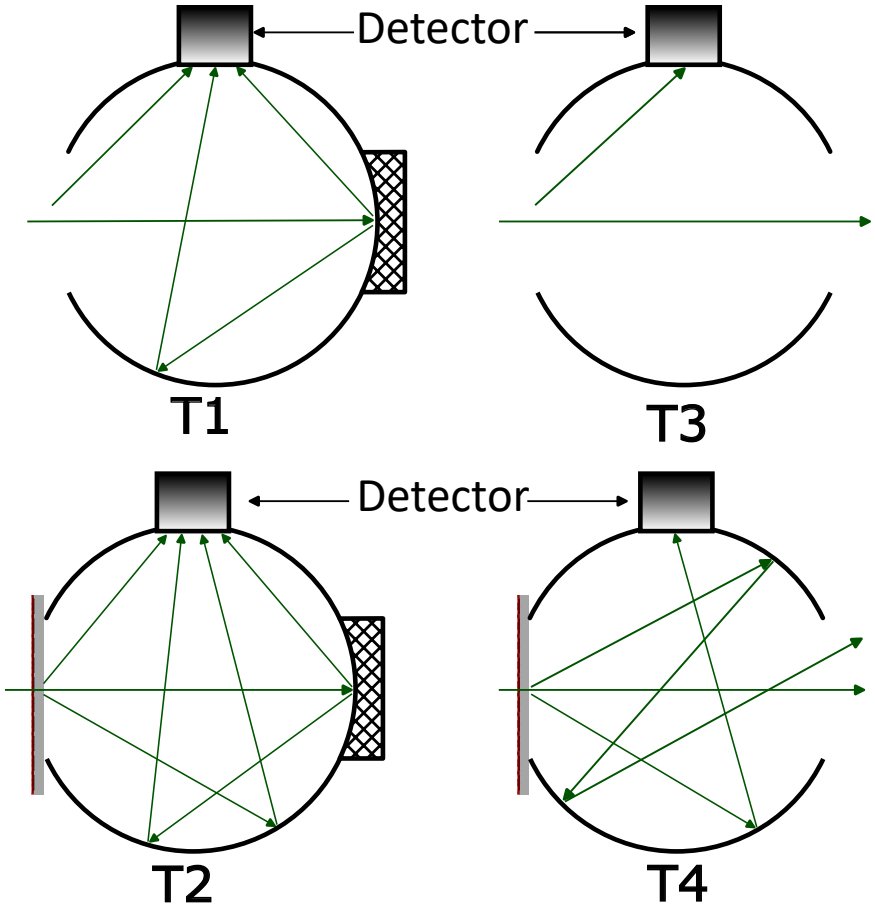

Fig. S4 Schematic representation of the four measures necessary to calculate the haze of a sample using an integrating sphere

Transmittance data for all samples *AgNWs + TiO_2 AfterPC* crystallized in anatase and rutile

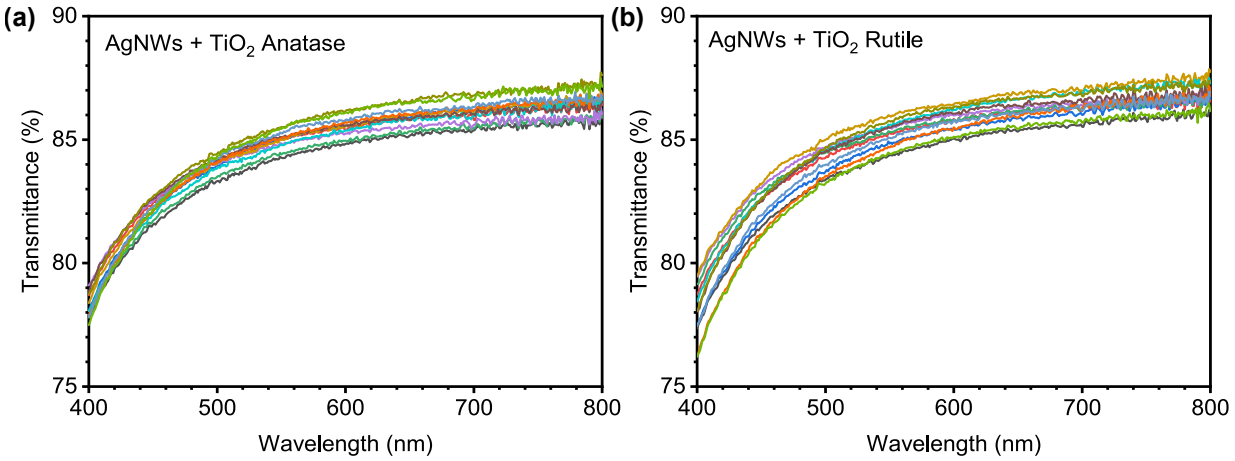

Fig. S5 Transmittance for the finalized samples after the last photonic curing processing, *AgNWs + TiO_2 AfterPC* (a) Samples crystallized into anatase (b) Samples crystallized into rutile

Additional developing solution test results

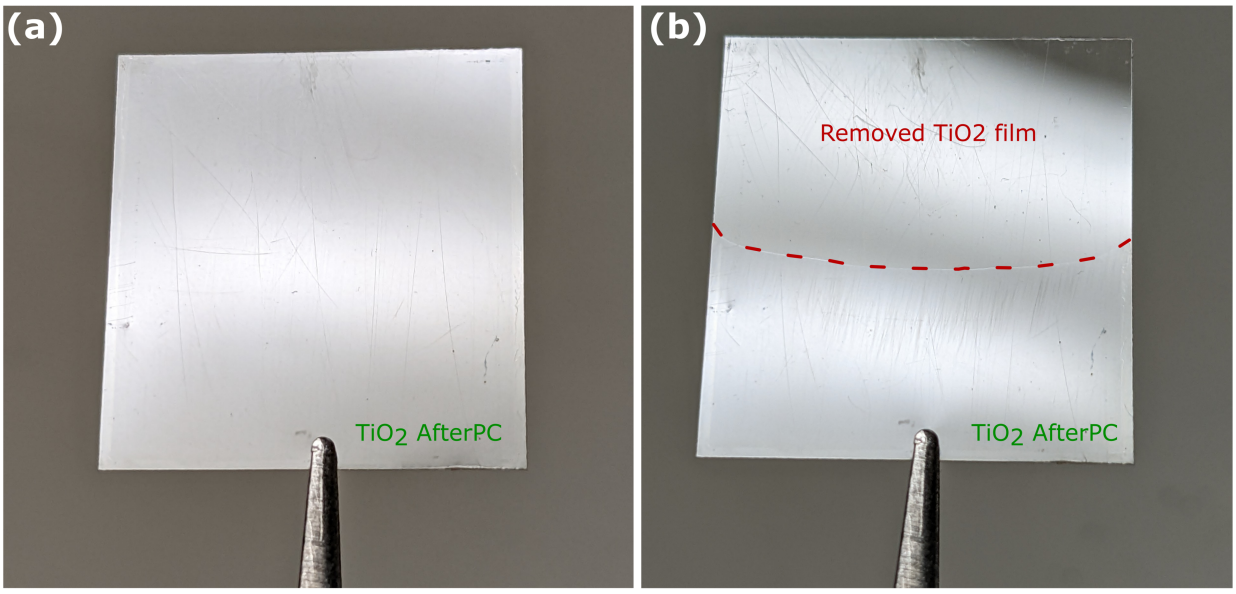

Fig. S6 Only TiO_2 layer deposited atop PET unsuccessfully crystallized (a) In here, the film was treated using the same photonic sintering conditions presented in the manuscript to obtain the rutile phase (b) The same film after 10s of submersion in the *DevSol* test and subsequent washing using DI water, showing the removal of the TiO_2 in the exposed area. The red dashed line follows the thin film line and facilitates the discrimination of the two areas

References

[1] C. Preston, Y. Xu, X. Han, J. N. Munday and L. Hu, *Nano Research*, 2013, **6**, 461–468.

[2] H. L. Yu, C. C. Hsiao and W. C. Liu, *Measurement Science and Technology*, 2006, **17**, N29–N36.