

## Supporting information

Fabrication of a nanoscale 2D PEDOT pattern via the combination of colloidal lithography and vapor phase polymerization for application in transparent, highly sensitive bending sensors

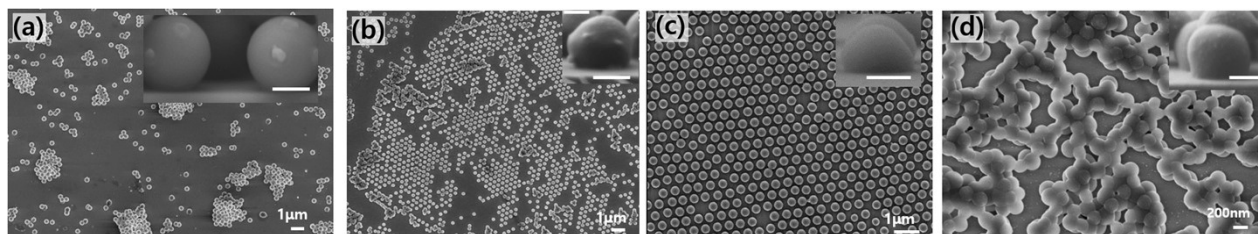
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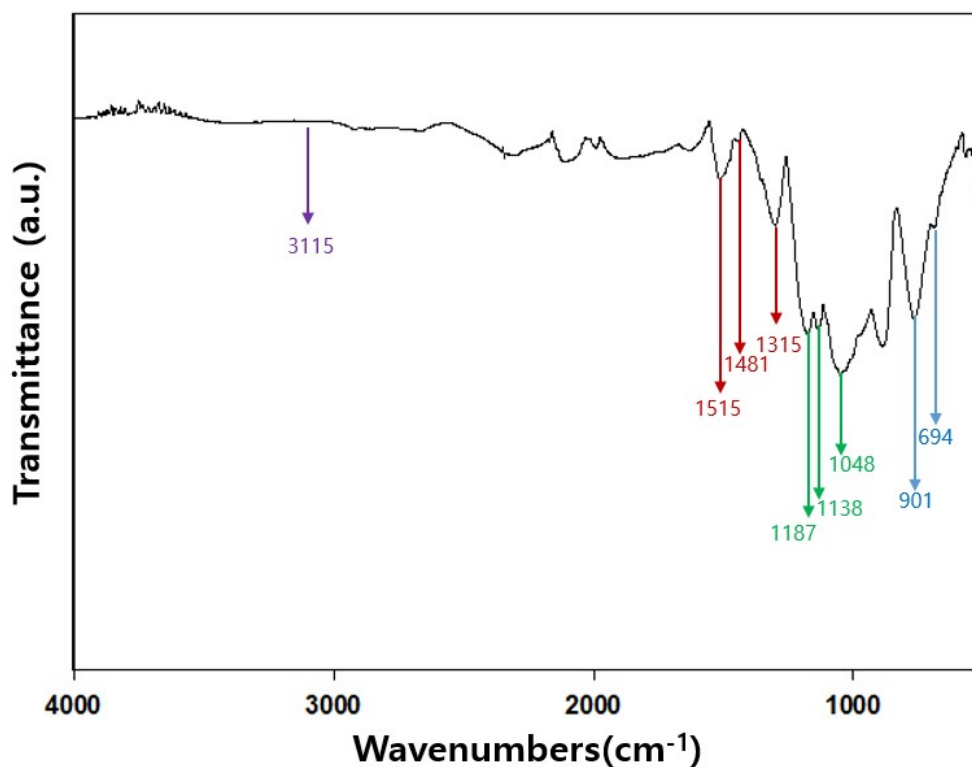
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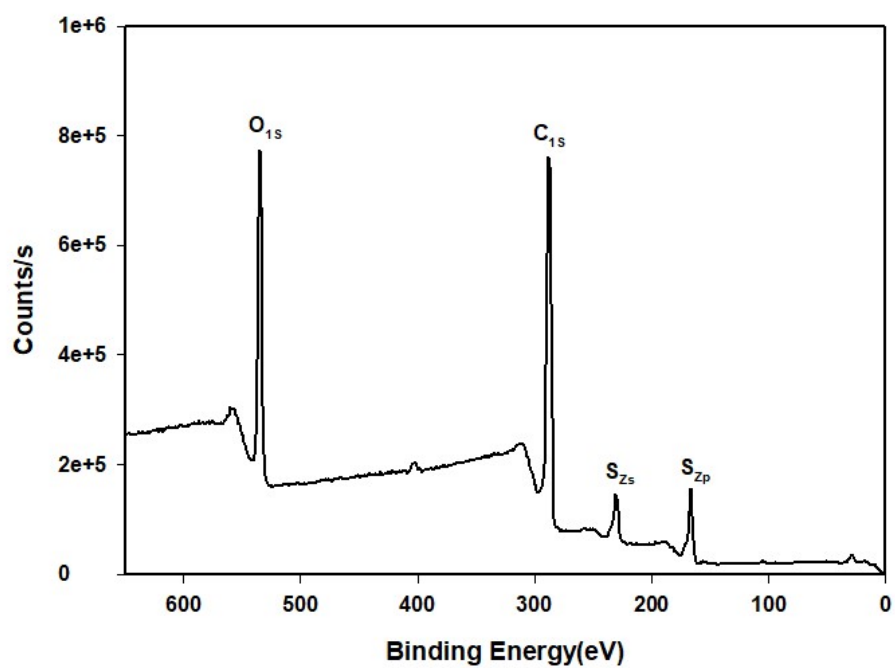


**Figure S1.** SEM images of colloidal crystal arrays transferred at different temperatures (a) 105°C, (b) 110°C, (c) 115°C and (d) 125°C and their cross-sectional images (insets) respectively. Scale bars in inset images are 200nm.

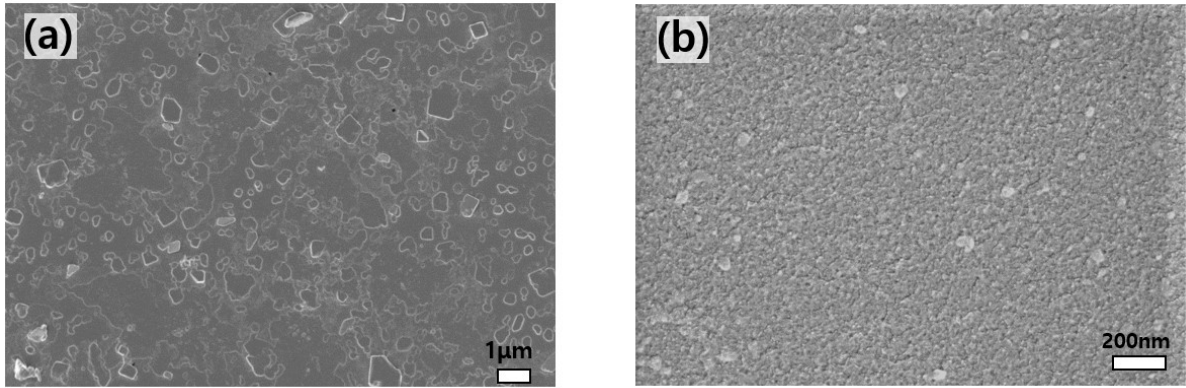


**Figure S2.** FT-IR spectrum of patterned PEDOT film on glass substrate.

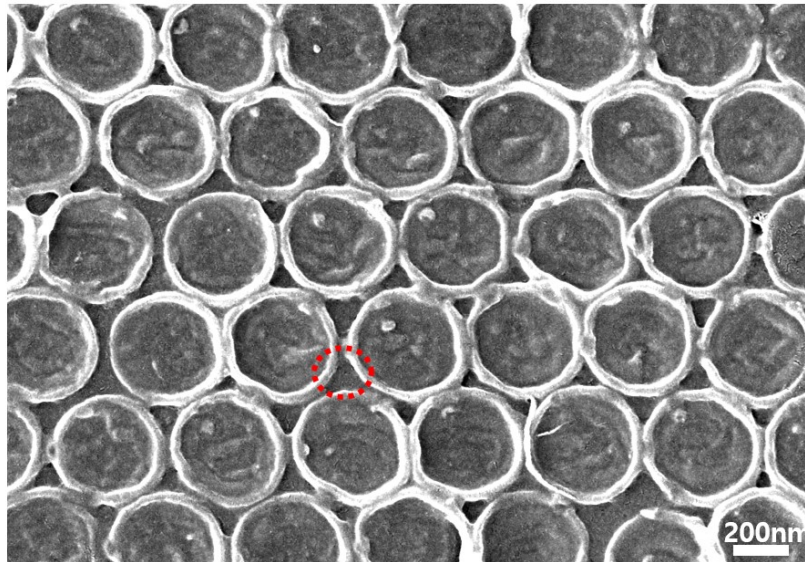
The bands at 1515, 1481, 1315  $\text{cm}^{-1}$  are attributed to the stretching modes of C=C and C-C in the thiophene ring. The bands at 1187, 1138, 1048  $\text{cm}^{-1}$  are attributed C-O-C bending vibration in ethylenedioxy group. The bands at 901, 694  $\text{cm}^{-1}$  are characteristic of the stretching vibration of C-S-C bond in the thiophene ring. The band at 3115  $\text{cm}^{-1}$  is assigned for 2, 5-hydrogen atom on the thiophene ring in EDOT monomer. The absence of the 3115  $\text{cm}^{-1}$  band indicates the formation of PEDOT polymer chains.<sup>1-3</sup>



**Figure S3.** XPS spectrum of patterned PEDOT film. The elements of PEDOT (O, C, and S) are clearly shown, while Fe is not detected.

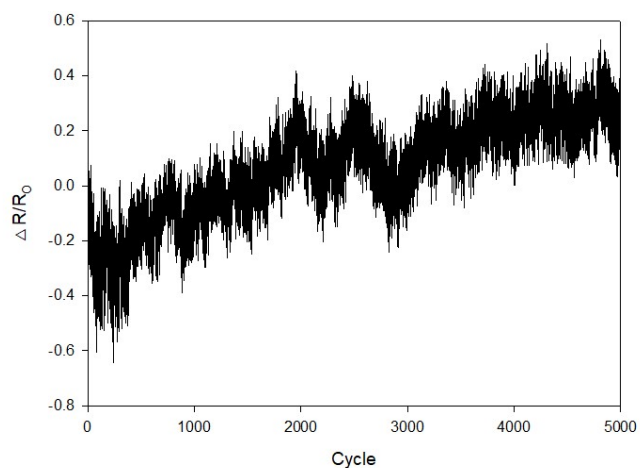


**Figure S4.** SEM images of Un-patterned (a) FTS oxidant layer and (b) PEDOT film.



**Figure S5.** SEM image of Patterned PEDOT film formed on a stretchable substrate (thermoplastic polyurethane (TPU) film).

The low wettability of the TPU generated voids not only in the areas where the colloidal particles were, but also in the interparticle region (red circle), resulting in the PEDOT ring array. The narrowed electrical pathway reduces electrical conductivity. In order to apply it as a strain sensor, further study is needed to increase the electrical conductivity.



**Figure S6.** Reliability test for 5000 cycles under 9.5R bending condition of patterned PEDOT VPP film.

### Reference

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- 2 B. R. Pistillo, K. Mengueli, N. Desbenoit, D. Arl, R. Leturcq, O. M. Ishchenko, M. Kunat, P. K. Baumann and D. Lenoble, *J. Mater. Chem. C*, 2016, **4**, 5617–5625.
- 3 J. Kim, J. You and E. Kim, *Macromolecules*, 2010, **43**, 2322–2327.