Electronic Supplementary Material (ESI) for Journal of Materials Chemistry C.
This journal is © The Royal Society of Chemistry 2020

Supporting Information

Simplified Fabrication of Hierarchical Structure for Flexible Pressure Sensor with Wide Linearity Range and Highly Sensitive

Zhaoyang Li, [a, b] Bo Zhang, [a b] Kun Li, [a b] Tong Zhang,*[a, c] and Xiaoniu Yang [a, c]

[a] State Key Laboratory of Polymer Physics and Chemistry, Changchun Institute of Applied Chemistry, Chinese Academy of Sciences, 5625 Renmin Street, Changchun 130022, P. R. China

[b] School of Applied Chemistry and Engineering, University of Science and Technology of China, Jinzhai Road No 96, Hefei 230026, P. R. China

[c] Polymer Composite Engineering Laboratory, Changchun Institute of Applied Chemistry, Chinese Academy of Sciences, 5625 Renmin Street, Changchun 130022, P. R. China

Content

Table S1. The Sensitivity and Linearity Range of Flexible Pressure Sensors with Surface Microstructures.

In the ABS mold fabrication process, we marked the acrylonitrile butadiene styrene (ABS) mold with smooth surface and rough surface at the laser current of 6A, respectively. After the laser marking, it could be observed that the hierarchical microstructures could be acquired by marking the ABS mold with smooth surface. When the surface of ABS mold possessed rough surface, the hemispherical microstructures were obtained.

To further verify the influence of ABS mold roughness, the ABS mold with smooth surface was polished by 800# sandpaper. From Figure S1a-c, it could be found that ABS mold became rougher after it was polished by sandpaper. The roughness of the ABS mold might influence how the ABS mold and the laser interacted on the surface, and therefore the morphologies of polydimethylsiloxane (PDMS) (peeled off from the polished ABS mold by 800# sandpaper, 800#-PDMS) were investigated. Firstly, the polished ABS mold was marked by laser marking machine. Then the PDMS mixture was drop-casted onto the prepared mold. After curing, the replicated surface structure of the ABS mold was peeled off. As displayed

in Figure S1d-f, it could be observed that the top view of peeled-off 800#-PDMS SEM images were similar to the hemispherical microstructure (Figure S1d). The results suggested that the hierarchical microstructure of the marked ABS mold was significantly associated with the surface roughness of ABS mold.

Furthermore, in the past reports, the researchers have focused on searching the interaction between the laser and the nonmetallic material.[1] They found that the laser marking intensity was closely related to the incident angles of laser. The roughness of the nonmetallic material surface was directly affected by the incident angles of laser. Hence, the roughness of the nonmetallic material surface might also influence the interaction between the laser and ABS mold.

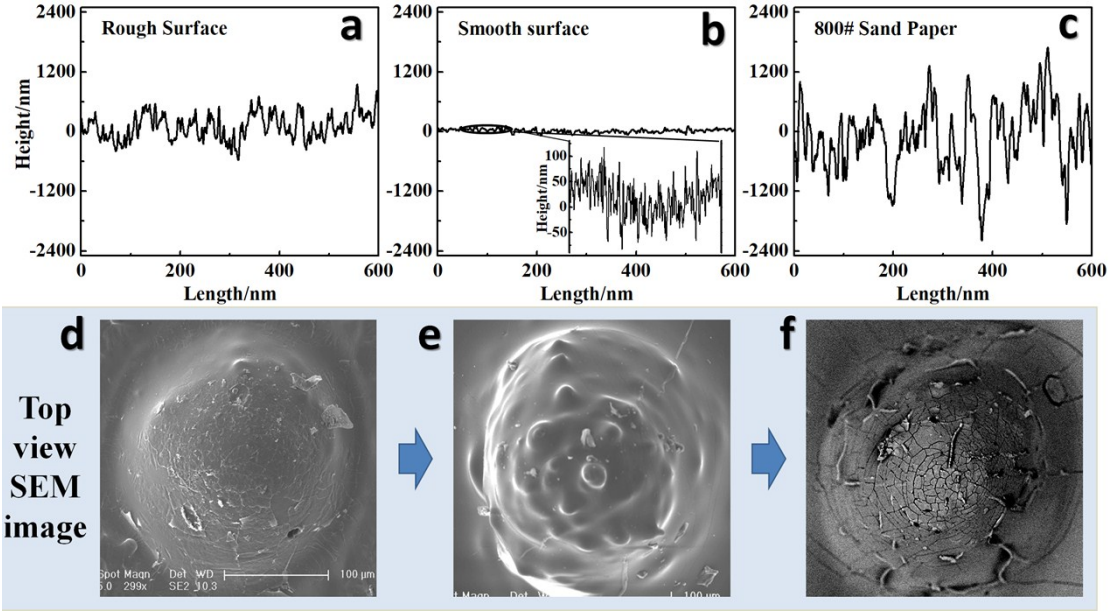

Figure S1. The surface roughness of the rough ABS mold, b), and the smooth ABS mold c) the polished ABS mold by 800# sandpaper. Top-view SEM images of d) the hemispherical microstructure, e) the hierarchical microstructure, and f) the hemispherical microstructure (800#).

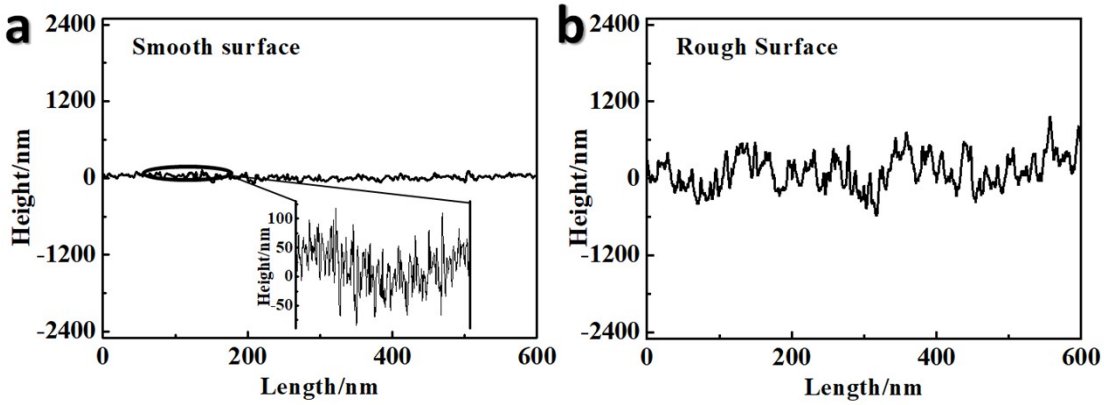

Figure S2. a) The surface roughness of the smooth ABS mold, and b) the rough ABS mold.

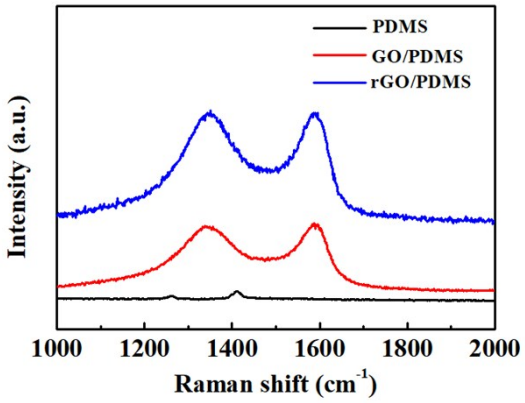

Figure S3. a) Raman spectra of PDMS, PDMS with GO layers and PDMS with rGO layers.

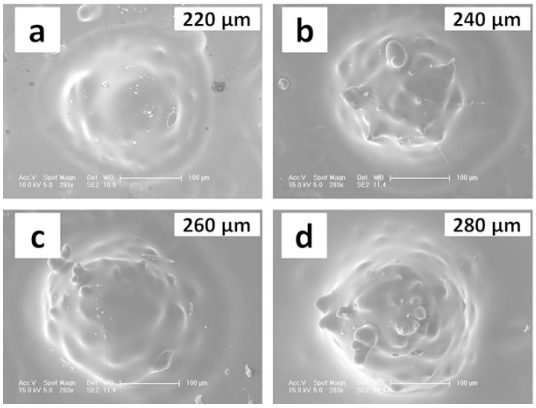

Figure S4. Top-view SEM images of microstructure with the diameter of, a) 220 µm b) 240 µm c) 260 µm d) 280 µm.

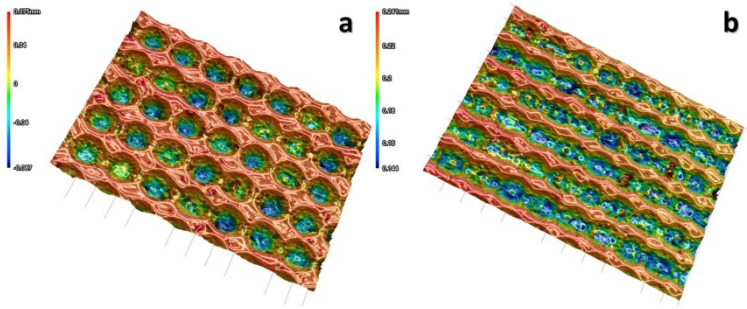

Figure S5 The 3D optical image of the hierarchical microstructure arrays with the pitch of a) 350 μm, b) 300 μm.

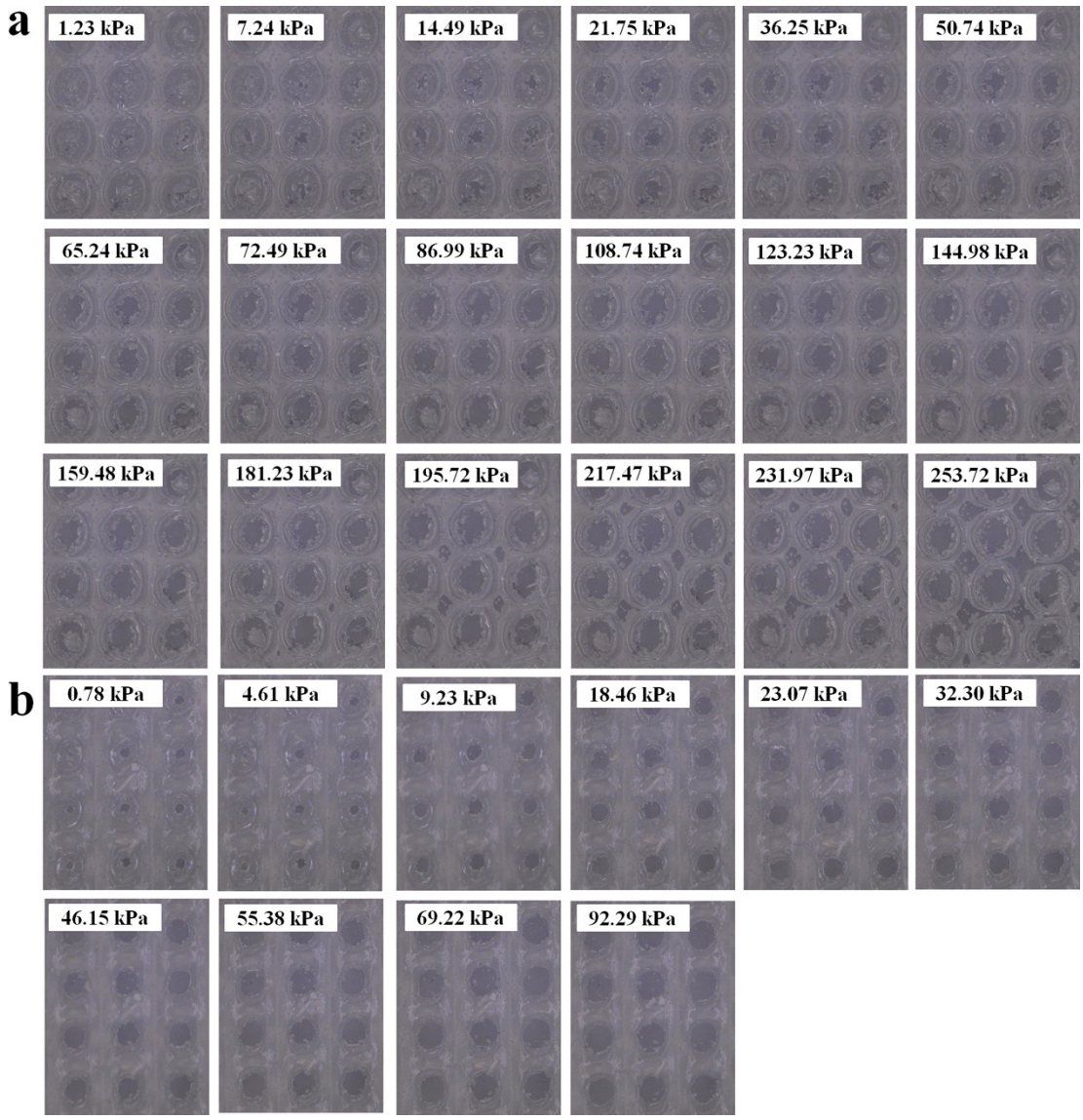

Figure S6. a) Optical images of hierarchical structure arrays under pressure varied from 1.23 kPa to 253.72 kPa. b) Optical images of hemispherical structure arrays under pressure varied from 0.78 kPa to 92.29 kPa.

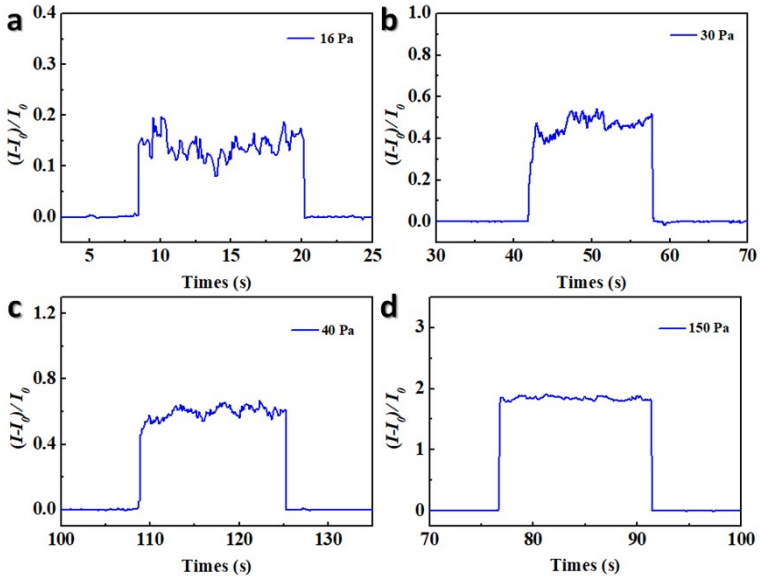

Figure S7. Limit of detection of the pressure sensor detemined through loading with pressure of a) 16 Pa, b) 30 Pa, c) 40 Pa, d) 150 Pa.

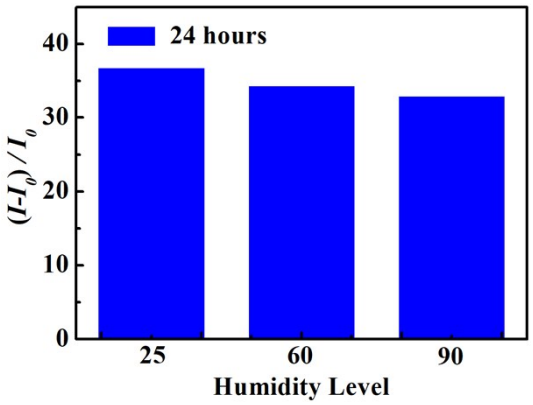

Figure S8. The humidity stability of the pressure sensor under different humidity storage with 24 hours.

Table S1. Sensitivity and linearity range of flexible pressure sensors with surface microstructures.

Sensitivity [kPa^{-1}]	Linearity Range [kPa]	Mold or Surface Microstructure	Conductive layer	Ref.
0.0064	100	Semi-sphere	water-based carbon	S2
20.08	0.8	Pillar	AgNWs	S3
0.02	50	Micro-dome	Carbon powder	S4
25.1	2.6	Sand paper	rGO	S5
10	0.5	Banana leaf	Silver	S6
15	5	Mono-dispersed PS	Gold	S7
851	20	Microhump	PEDOT:PSS	S8

8.5	12	Hierarchical structural	Graphene	S9
6.8	0.25	zinc oxide nanowire	Pt	S10
1.35	2	Rose petal	Cu/Ag core-shell nanowires	S11

References

S1 C. Niu, T Zhu and Y. *Lv, Int. J. Photoenergy.*, https://doi.org/10.1155 /2019/1476217.

S2 A. dos Santos, N. Pinela, P. Alves, R. Santos, R. Farinha, E. Fortunato, R. Martins, H. Águas and R. Igreja, *Sensors*, 2019, **19**, 899.

S3 Y. Mao, B. Ji, G. Chen, C. Hao, B. Zhou and Y. Tian, *ACS Appl. Nano Mater.,* 2019, **2**, 3196-3203.

S4 Q. Zhou, B. Ji, G. Chen, Y. Ding, J. Wu, J. She, S. Wang and B. Zhou, *ACS Appl. Nano Mater.*, 2019, DOI: 10.1021/acsanm.9b01680.

S5 Y. Pang, K. Zhang, Z. Yang, S. Jiang, Z. Ju, Y. Li, X. Wang, D. Wang, M. Jian, Y. Zhang, R. Liang, H. Tian, Y. Yang and T. L. Ren, *ACS Nano*, 2018, **12**, 2346-2354.

S6 P. Nie, R. Wang, X. Xu, Y. Cheng, X. Wang, L. Shi and J. Sun, *ACS Appl. Mater. Interfaces*, 2017, **9**, 14911-14919.

S7 Y. Zhang, Y. Hu, P. Zhu, F. Han, Y. Zhu, R. Sun and C. P. Wong, *ACS Appl. Mater. Interfaces*, 2017, **9**, 35968-35974.

S8 Z. Wang, S. Wang, J. Zeng, X. Ren, A. J. Chee, B. Y. Yiu, W. C. Chung, Y. Yang, A. C. Yu, R. C. Roberts, A. C. Tsang, K. W. Chow and P. K. Chan, *Small*, 2016, **12**, 3827-3836.

S9 G. Y. Bae, S. W. Pak, D. Kim, G. Lee, D. H. Kim, Y. Chung and K. Cho, *Adv. Mater.*, 2016, **28**, 5300-5306.

S10 M. Ha, S. Lim, J. Park, D.-S. Um, Y. Lee and H. Ko, *Adv. Funct. Mater.*, 2015, **25**, 2841-2849.

S11 Y. Wei, S. Chen, Y. Lin, Z. Yang and L. Liu, *J. Mater. Chem. C*, 2015, **3**, 9594-9602.