Supporting Information for

An Intrinsically Stretchable Humidity Sensor Based on Anti-drying, Self-healing and Transparent Organohydrogel

Jin Wu*[a], Zixuan Wu[a], Huihua Xu[a], Qian Wu[a], Chuan Liu[a], Bo-Ru Yang[a], Xuchun Gui[a], Xi Xie[a], Kai Tao*[b], Yi Shen*[c], Jianmin Miao[d], and Leslie K. Norford[e]

[a]State Key Laboratory of Optoelectronic Materials and Technologies and the Guangdong Province Key Laboratory of Display Material and Technology, School of Electronics and Information Technology, Sun Yat-sen University, Guangzhou 510275, China

[b]The Ministry of Education Key Laboratory of Micro and Nano Systems for Aerospace, Northwestern Polytechnical University, Xi'an, 710072, China.

[c]School of Food Science and Engineering, South China University of Technology, Guangzhou 510640, People's Republic of China

[d]School of Mechanical and Aerospace Engineering, Nanyang Technological University, Singapore 639798, Singapore

[e]Department of Architecture, Massachusetts Institute of Technology, Cambridge, MA 02139, USA

*Correspondence should be addressed to J. W. (Email: wujin8@mail.sysu.edu.cn) or K. T. (E-mail: taokai@nwpu.edu.cn) or Y. S. (E-mail:feyshen@scut.edu.cn)

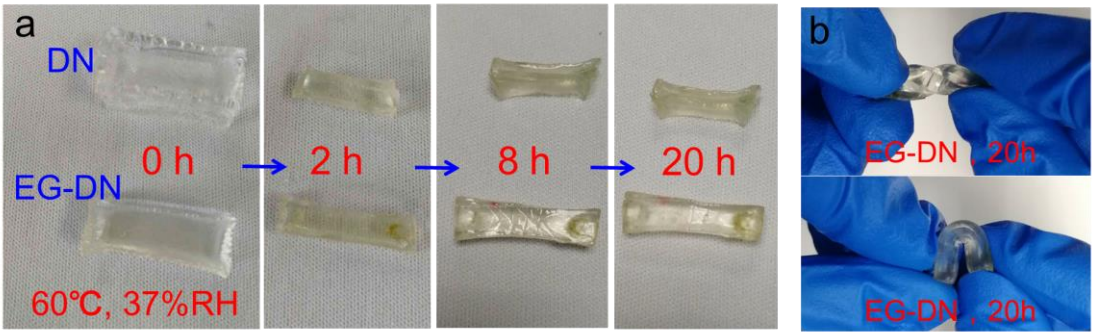

Figure S1. a) Photographs of the DN hydrogel (above) and EG-DN organohydrogel (below) placed at 60 ℃ and 37% relative humidity (RH) for 0, 2, 8 and 20 h, respectively. b) Digital images showing that the EG-DN organohydrogel stored at 60 ℃ and 37% RH for 20 h can still be twisted for 360 ° (above) and bent for 155 ° (below). In contrast, the DN hydrogel became dried at 20 h and therefore could not withstand such mechanical deformations.

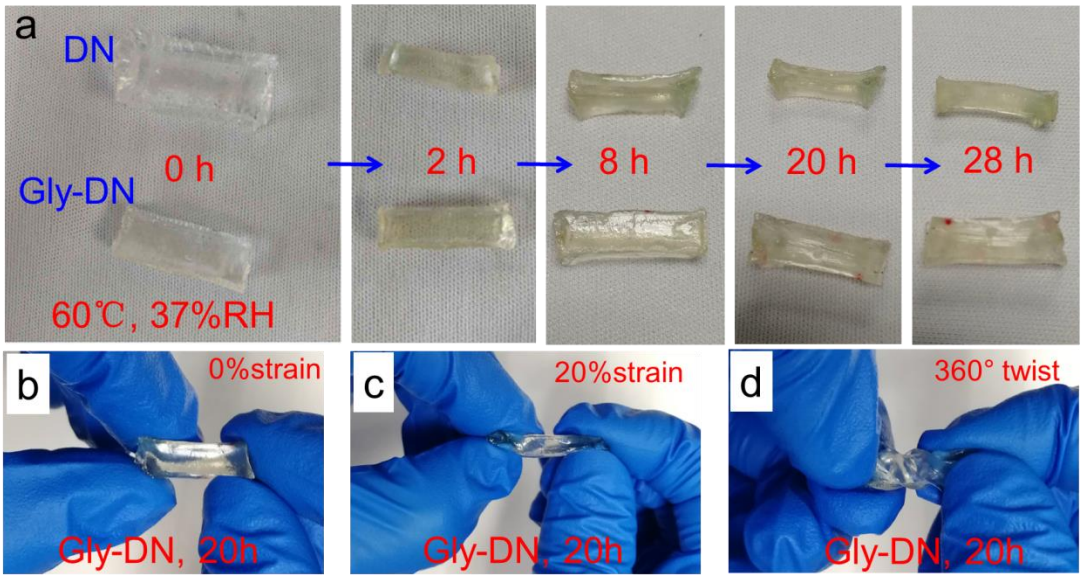

Figure S2. a) Photographs of the DN hydrogel (above) and Gly-DN organohydrogel (below) stored at 60 ℃ and 37% RH for 0, 2, 8, 20 and 28 h, respectively. b-d) Photographs showing that the Gly-DN organohydrogel stored at 60 ℃ and 37% RH for 50 h can still be stretched for 20% strain (b-c) and twisted for 360 °(d).

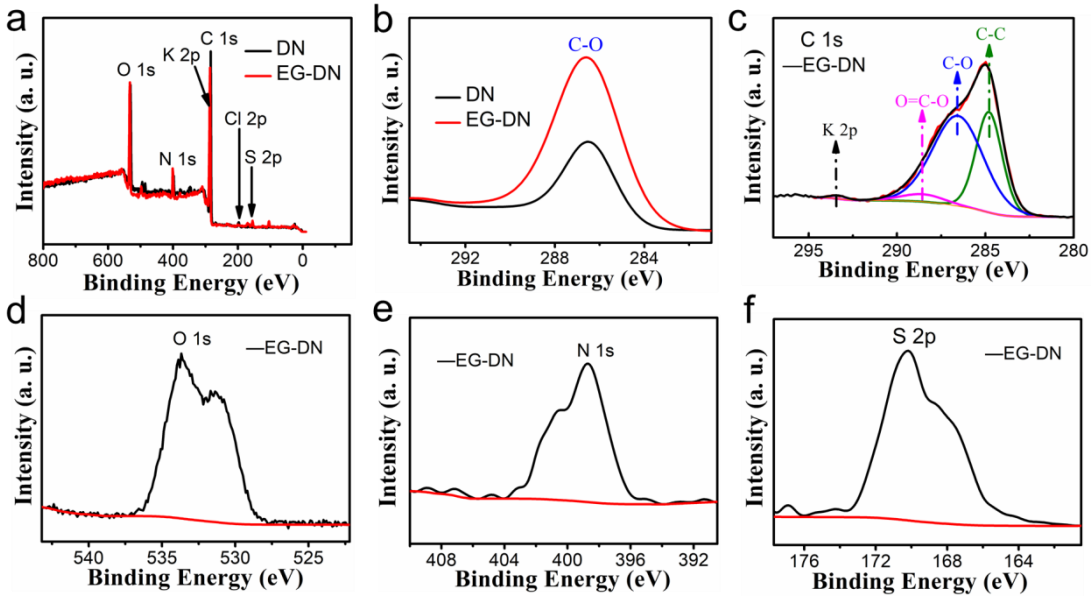

Figure S3. a) X-ray photoelectron spectroscopy (XPS) spectra of the DN hydrogel and EG-DN organohydrogels. b) Analysis of the C-O bond in the C 1s XPS spectra of the DN hydrogel and EG-DN organohydrogels. c) C 1s XPS spectra of the EG-DN organohydrogel. d), e) and f) O 1s, N 1s and S 2p XPS spectra of the EG-DN organohydrogel, respectively.

Table S1. XPS elemental analyses of the DN hydrogel and EG-DN organohydrogel

Element	DN Atomic (%)	EG-DN Atomic (%)
C	78.13	71.98
O	16.03	18.97
N	5.11	7.72
S	0.74	1.33

Table S2. C1s XPS analyses of the DN hydrogel and EG-DN organohydrogel

C 1s	DN Atomic (%)	EG-DN Atomic (%)
C-C	74.52	34.95
C-O	20.97	60.73
O=C-O	4.5	4.32

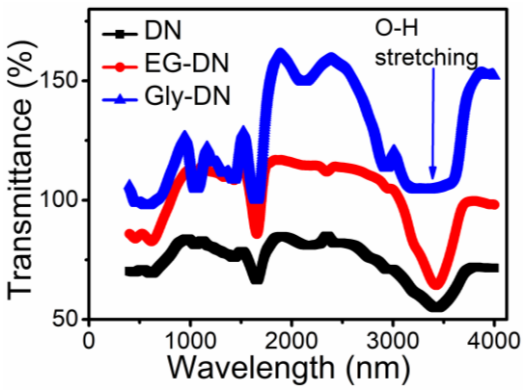

Figure S4. Fourier transform infrared (FTIR) spectra of the DN hydrogel, EG-DN and Gly-DN organohydrogels, respectively.

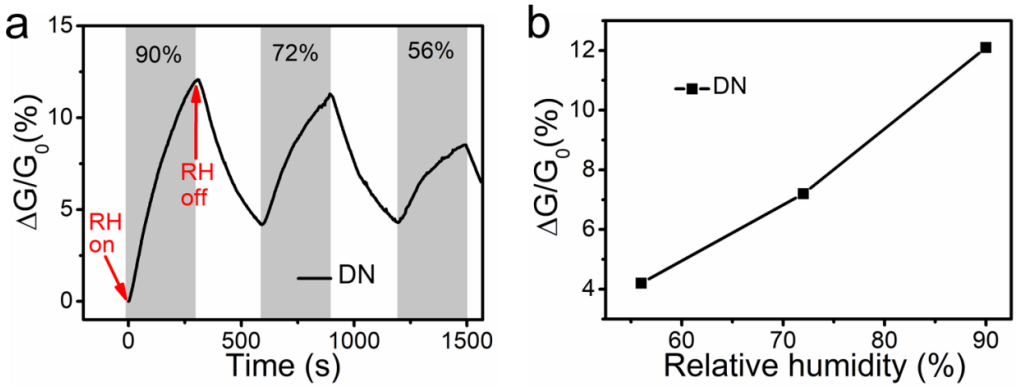

Figure S5. a) Real-time response of the unmodified DN hydrogel to different RH levels ranging from 90% to 56%. b) Plot of the quantitative response of the DN hydrogel sensor versus RH.

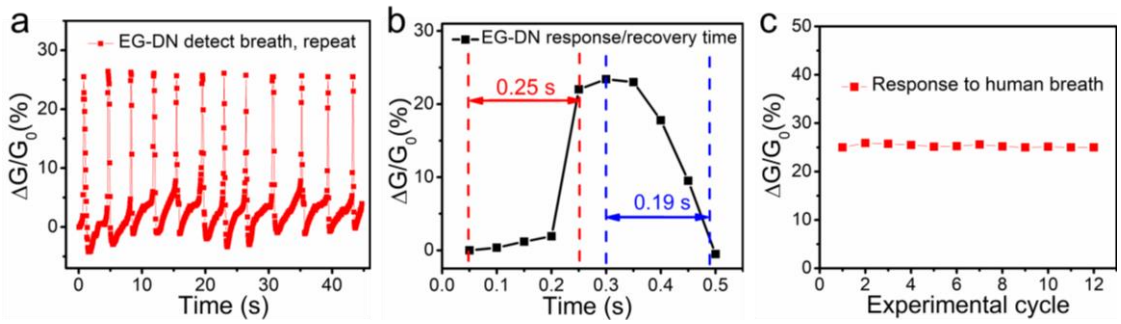

Figure S6. a) Dynamic response of the EG-DN sensor to human respiration for twelve repeated cycles. b) Analyses of the response and recovery time of the EG-DN sensor in the respiration monitoring. c) Plot of the response variation of the EG-DN sensor versus experimental cycle.

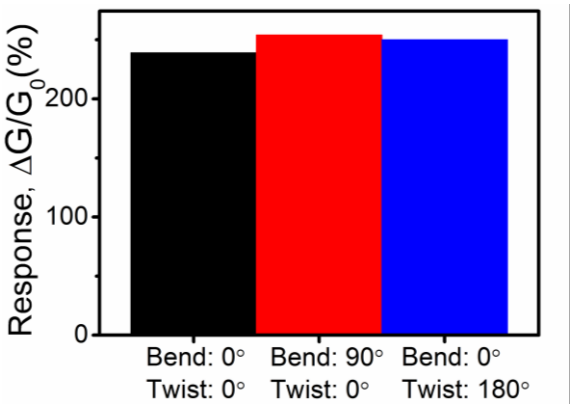

Figure S7. Comparison of the quantitative responses of the Gly-DN sensor at different mechanical deformations, including 0 ° bending and 0 ° twist (black), 90 ° bending and 0 °twist (red), and 0 °bending and 180 °twist (blue).

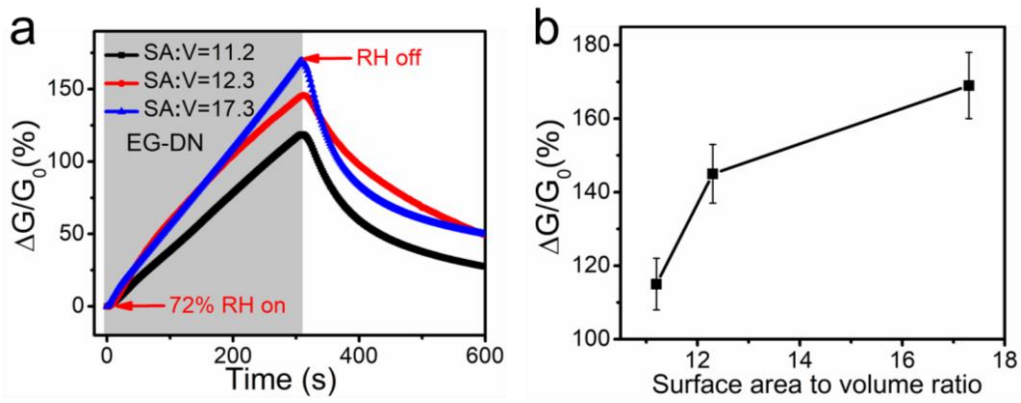

Figure S8. Investigation of the effect of surface-area-to-volume ratio (SA:V) on the sensitivity. a) Dynamic responses of the three EG-DN sensors with the SA:V of 11.2, 12.3 and 17.3, respectively, to 72% RH. b) Plot of the quantitative response to 72% RH versus the SA:V of the EG-DN organohydrogels. The cuboid-shaped EG-DN slices with the SA:V of 11.2, 12.3 and 17.3 have the dimensions of 2 cm × 6 cm × 0.2 cm, 1 cm × 6 cm × 0.2 cm, 0.5 cm × 6 cm × 0.2 cm, respectively.

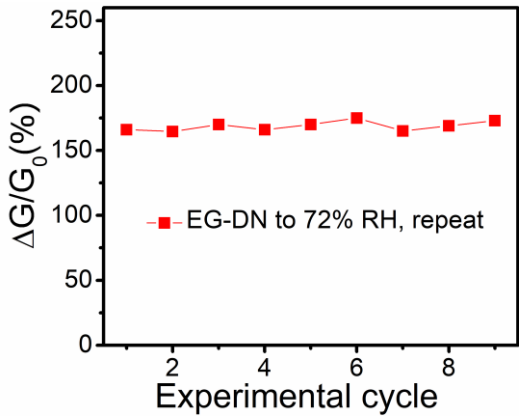

Figure S9. Plot of the quantitative responses of the EG-DN sensor to 72% RH versus experimental cycle.