

## Supporting Information for

# A Stretchable Humidity Sensor based on a Wrinkled Polyaniline Nanostructure

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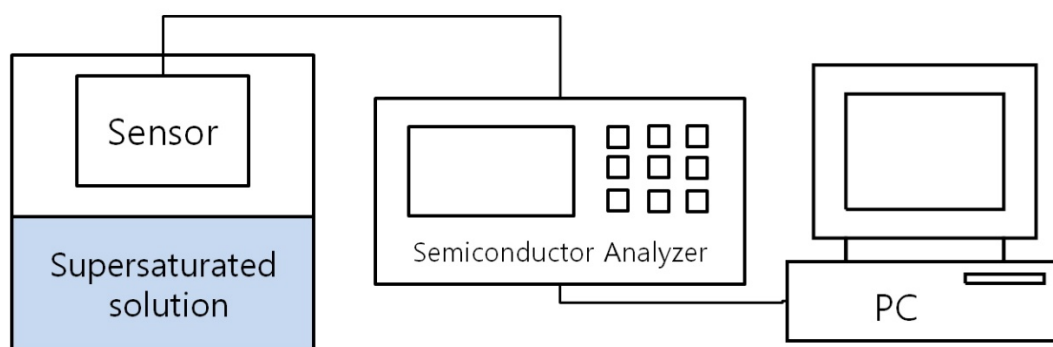
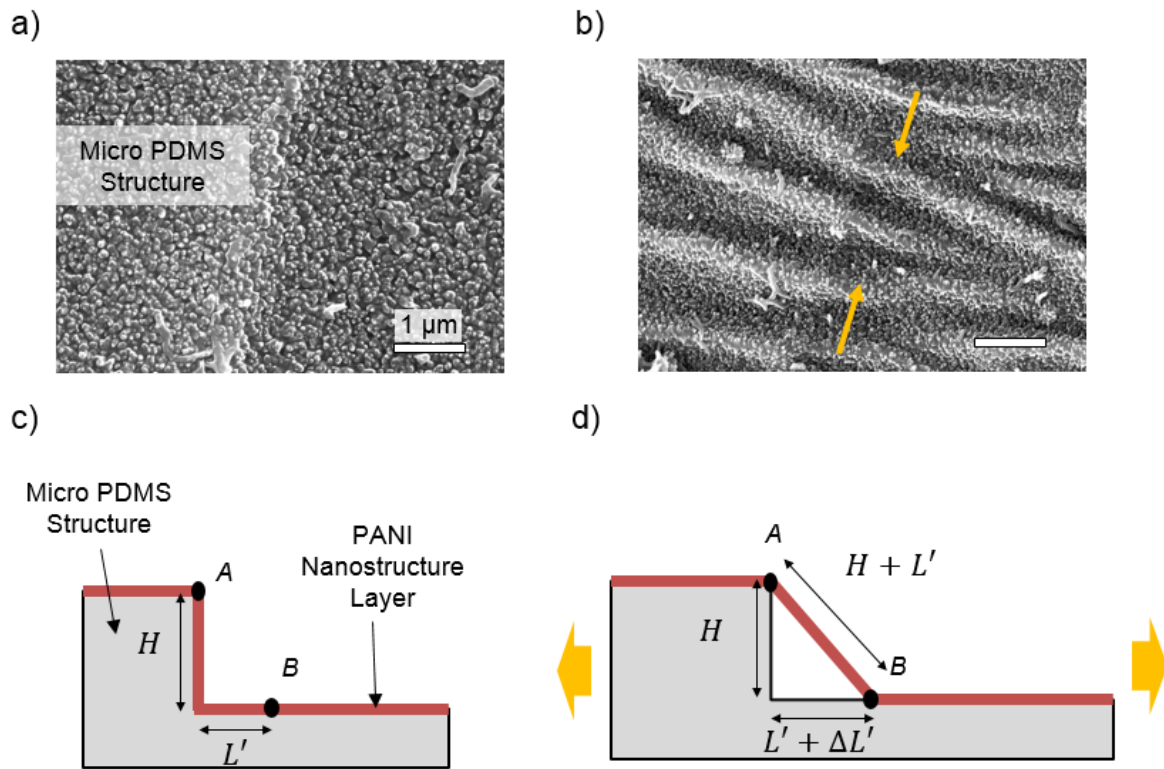
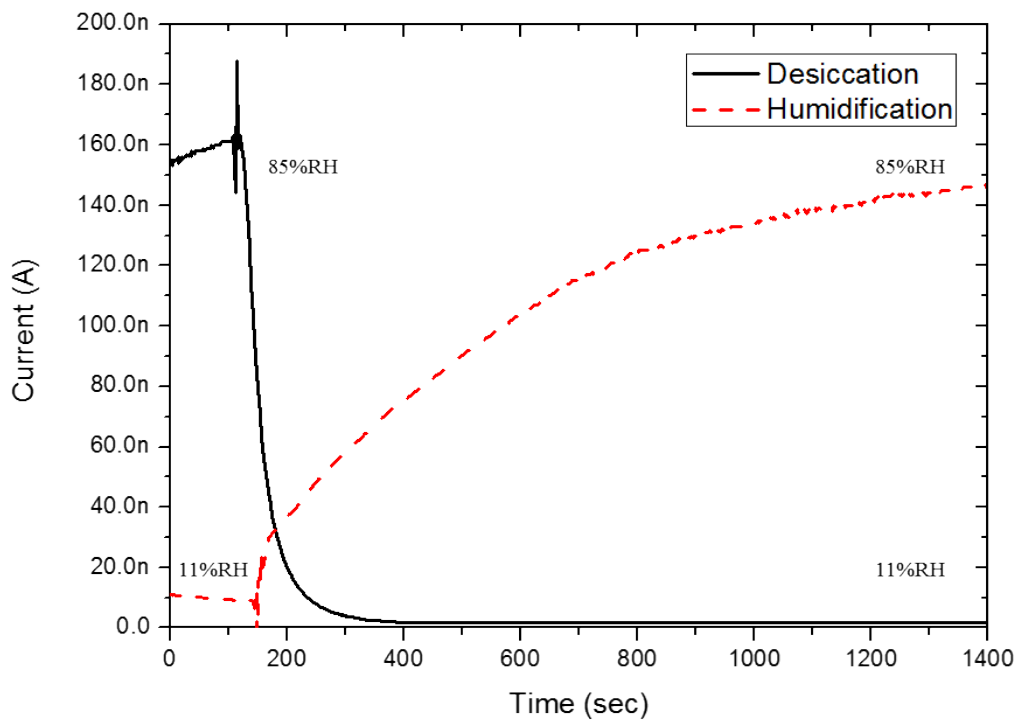


Fig. S1 Schematic of the experimental setting for humidity sensing



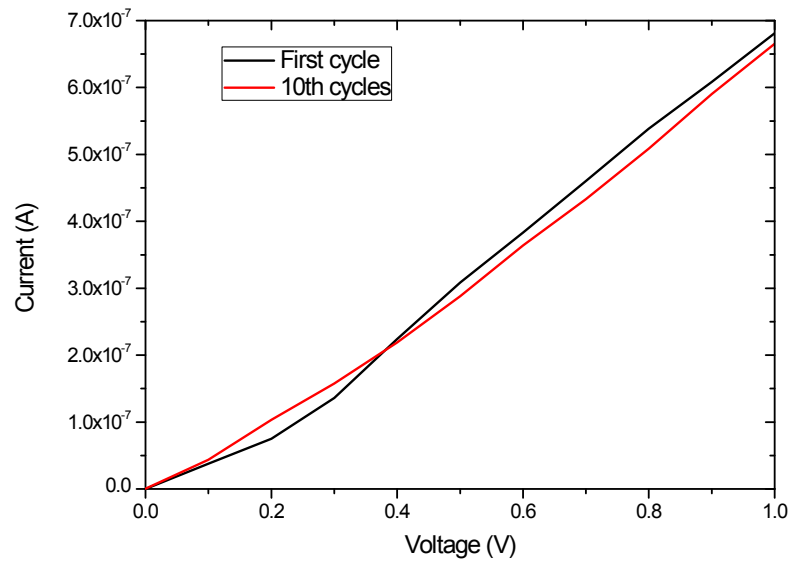
**Fig. S2** PDMS microstructure and detaching mechanism (a, b) PANI layer on the microstructure. (c, d) Schematic diagram for modeling PANI layer on microstructured PDMS substrate.

PDMS microstructure provides marginal length of nanostructure layer as shown in Fig S2. PANI layer on side of PDMS microstructure began to be detached as the strain on the substrate increased. Based on the geometrical change, we created a simple model of microstructured substrate, as shown in Fig S2. From the morphological analysis, the maximum strain ( $\Delta L'/L'$ ) is ca. 73% where the PDMS poisson's ratio is about 0.5.



**Fig. S3** Response and recovery properties of a stretchable humidity sensor at 1V DC, 25°C and 20% elongation.

The response time (humidification from 11%RH to 85%RH) was about 760 sec and recovery time (desiccation from 85%RH to 11%RH) was about 170 sec. The response or recovery time is defined by 90% of the spent time to reach another stable condition. This estimated response or recovery time include the time for a stable state in the room of the humidity chamber. Therefore, real response or recovery time of the humidity sensor in this research would be much shorter than measured value.



**Fig. S4** I-V graph after 10<sup>th</sup> stretching cycles

Fig. S4 shows a graph of the current versus voltage value after first and ten cycles. ('1 cycle' means the sensor is stretched from 100% to 400% of strain.) It maintains a similar range of the value after a cyclic test, as shown in Figure R1. Our sensor is operated by DC current between ends of PANI layer and the sensor signal basically depends on the change of conductivity of PANI. Thus, it means that the sensor keeps stable state after cyclic test.

Relative Humidity (% RH)	11	33	54	75	85	95
Salt	<u>LiCl</u>	MgCl <sub>2</sub>	Mg(NO <sub>3</sub> ) <sub>2</sub>	<u>NaCl</u>	<u>KCl</u>	KNO <sub>3</sub>

**Table. S1** Relative humidity dependence on supersaturation aqueous solutions of different salts in a closed chamber.