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Semiconducting single-walled carbon nanotube/graphene van der Waals junctions for highly sensitive all-carbon hybrid humidity sensors

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1. AFM image of (6, 5) SWCNT network on Ge substrate.

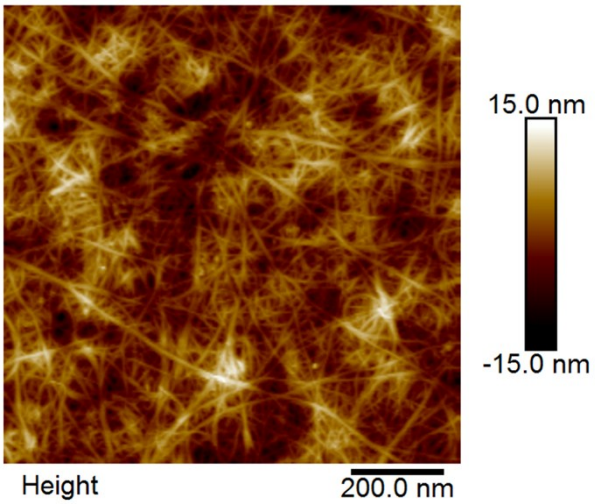

Fig. S1. AFM image of (6, 5) SWCNT network on Ge substrate.

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2. Raman spectra of (6, 5) SWCNTs wrapped by poly (9, 9-dioctyfluorene-2,7-diyl) (PFO) and pristine (6, 5) SWCNTs.

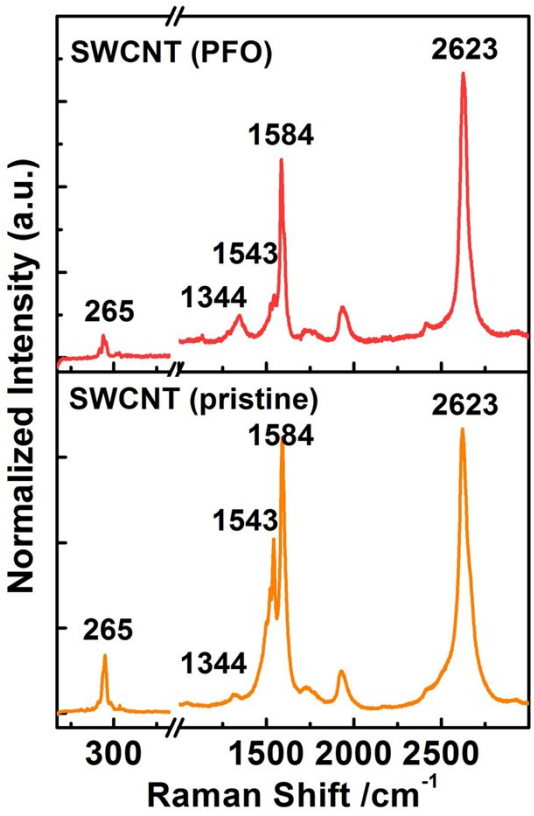

Fig. S2. Raman spectra of (6, 5) SWCNTs wrapped by poly (9,9-dioctyfluorene-2,7-diyl) (PFO) and pristine (6, 5) SWCNTs.

3. Raman spectra of pure graphene under different RHs.

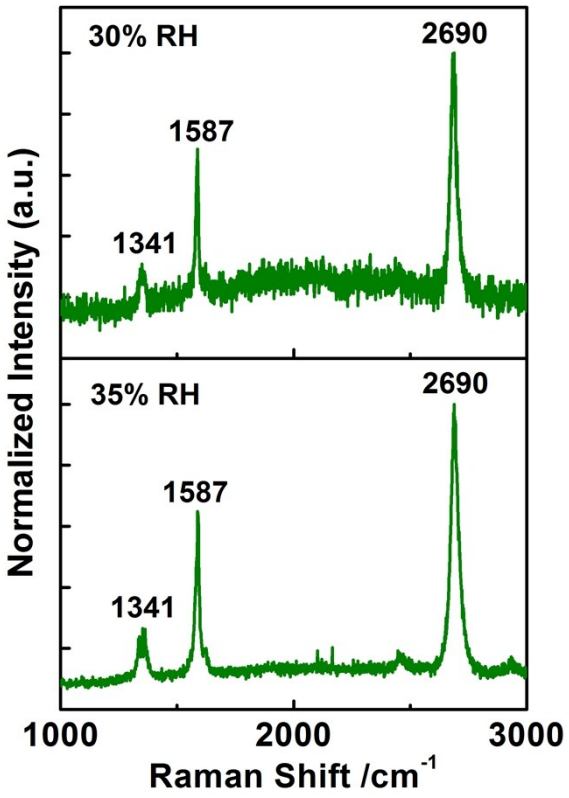

Fig. S3. Raman spectra of pure graphene under different RHs (30 % and 35 %).

4. Raman spectra of (6, 5) SWCNT/graphene vdW junctions that measured at 0% RH (dry air) and 30% RH.

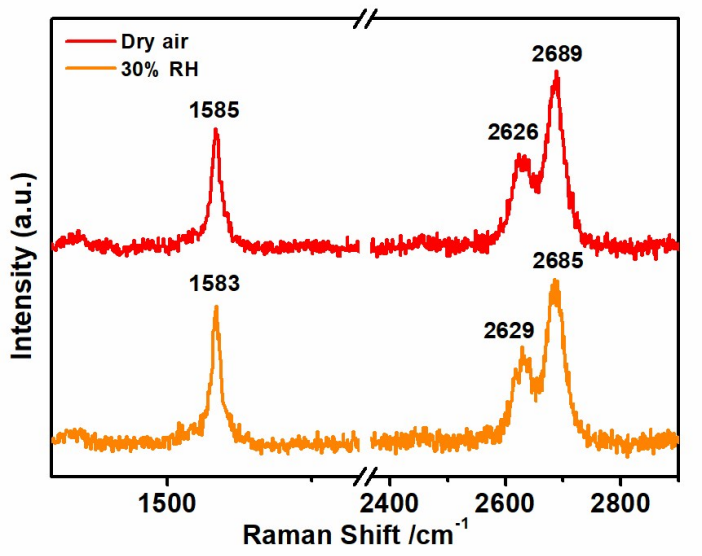

Fig. S4. Raman spectra of (6, 5) SWCNT/graphene vdW junctions under different conditions with 0% RH (dry air) and 30% RH.

This Raman spectroscopic characterization was carried out in a home-made chamber, where the RH value can be controlled by mixing humidity air with dry air.

5. SEM image of (6, 5) SWCNT/graphene vdW junctions in the device.

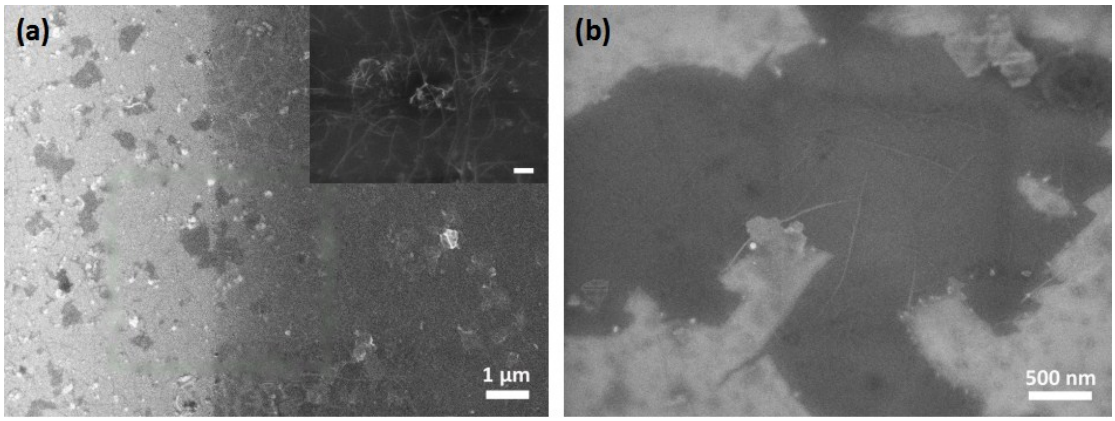

Fig. S5. (a) Typical SEM images of nanohybrids between electrode and channel, Inset, SEM image of nanohybrids in the channel, the scale bar is 500 nm. (b) A SEM image of the interface of nanohybrids in the channel.

6. Current-voltage curve of pure SWCNT device.

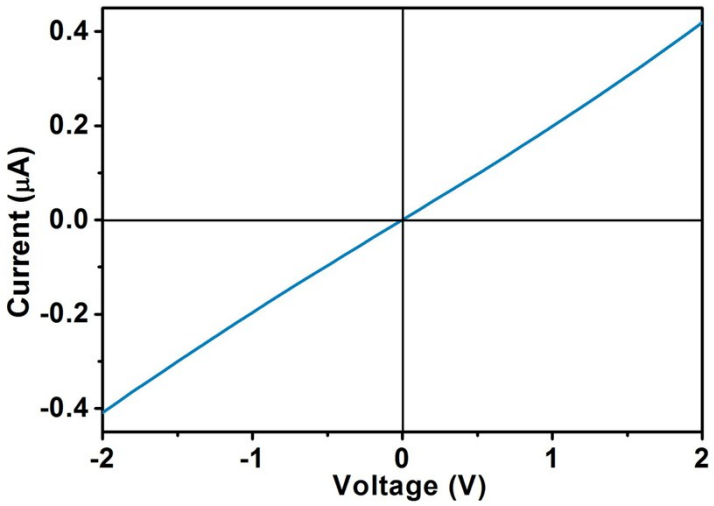

Fig. S6. Current-voltage curve of pure SWCNT device.

The current-voltage curve shows a good Ohmic contact is formed between gold and (6, 5) SWCNTs.

7. Current-time curve of pure SWCNT device.

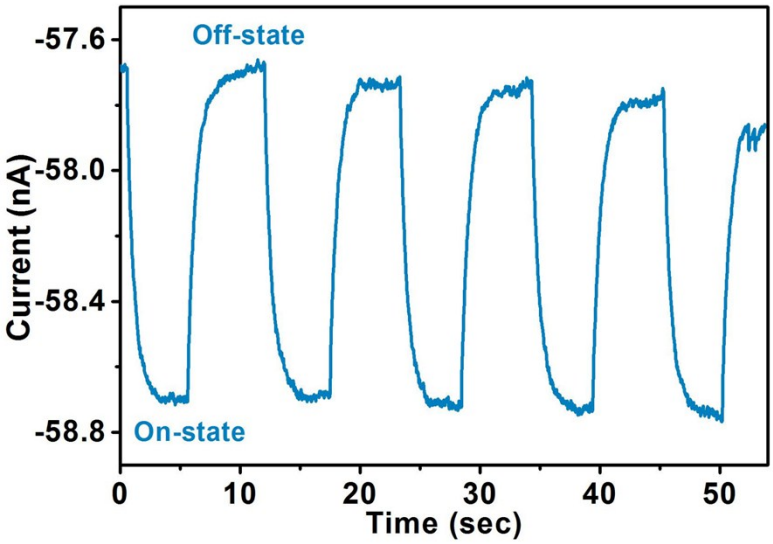

Fig. S7. Current-time curve of pure SWCNT device operating at - 0.5V under 30% RH.

The pure SWCNT device also exhibits good on/off-state switching behavior and fast response/recovery time. However, the sensitivity of the pure SWCNT device is 1.6%, which is much lower than that of the device based on the SWCNT/graphene hybrids (650%).