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# $TaS_2$ nanosheets-based ultrafast response and flexible humidity sensor for multifunctional applications

*Yu Feng,[a] Shijing Gong,[a] Erwei Du,[a] Ke Yu,[a,b,*] Jie Ren,[a] Zhenguo Wang [a] and Ziqiang Zhu [a]*

[a] Key Laboratory of Polar Materials and Devices (Ministry of Education of China), Department of Optoelectronics, East China Normal University, Shanghai 200241, China.

[b] Collaborative Innovation Center of Extreme Optics, Shanxi University, Taiyuan, Shanxi 030006, China.

[*] Corresponding author. E-mail: yk5188@263.net. Tel: +86-21-54345198;

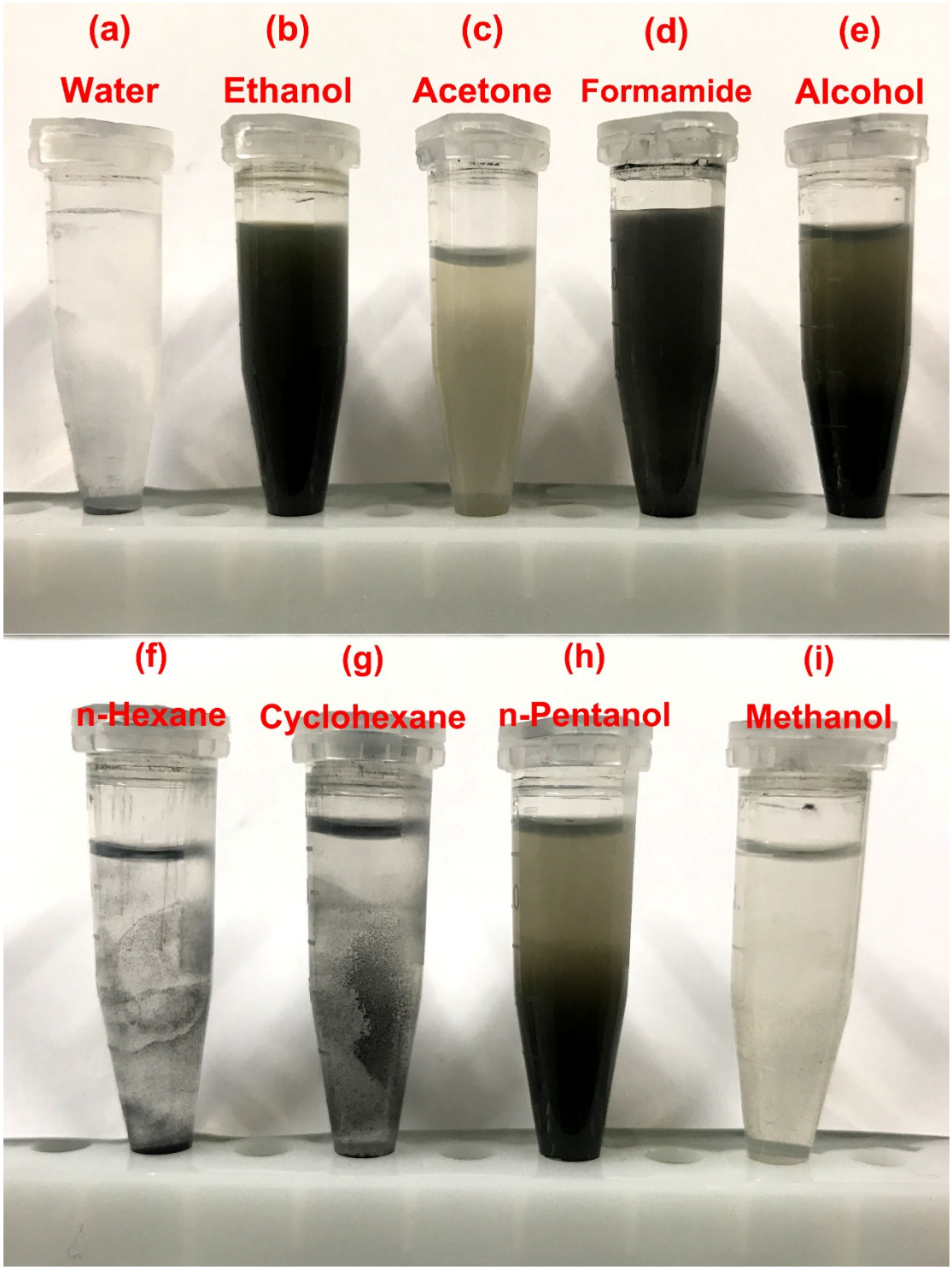


**Figure S1. Comparison of the exfoliation efficiency between various solvents.**

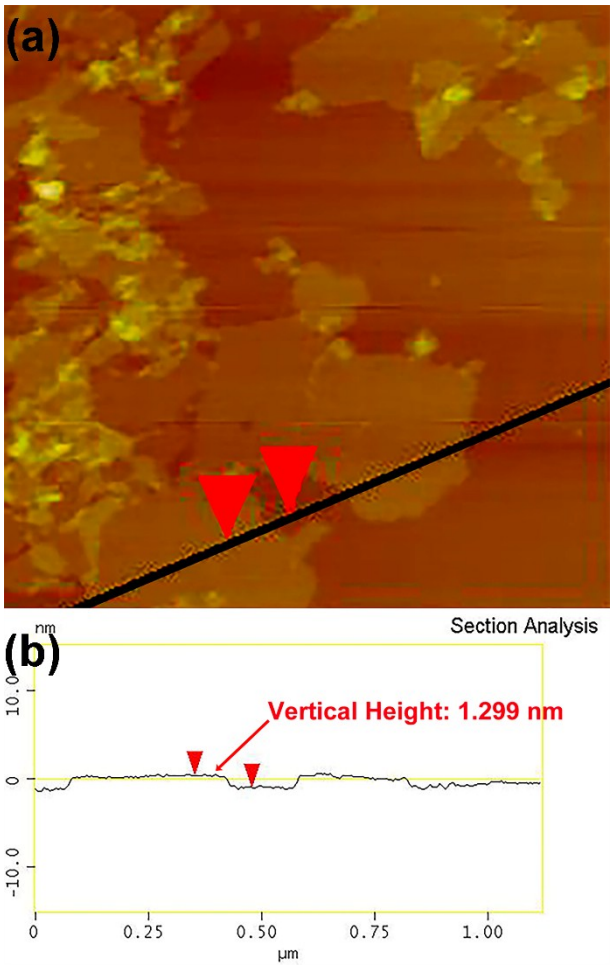


**Figure S2. (a) AFM image of $TaS_2$ nanosheets. (b) The height profile along the marked line in part (a).**

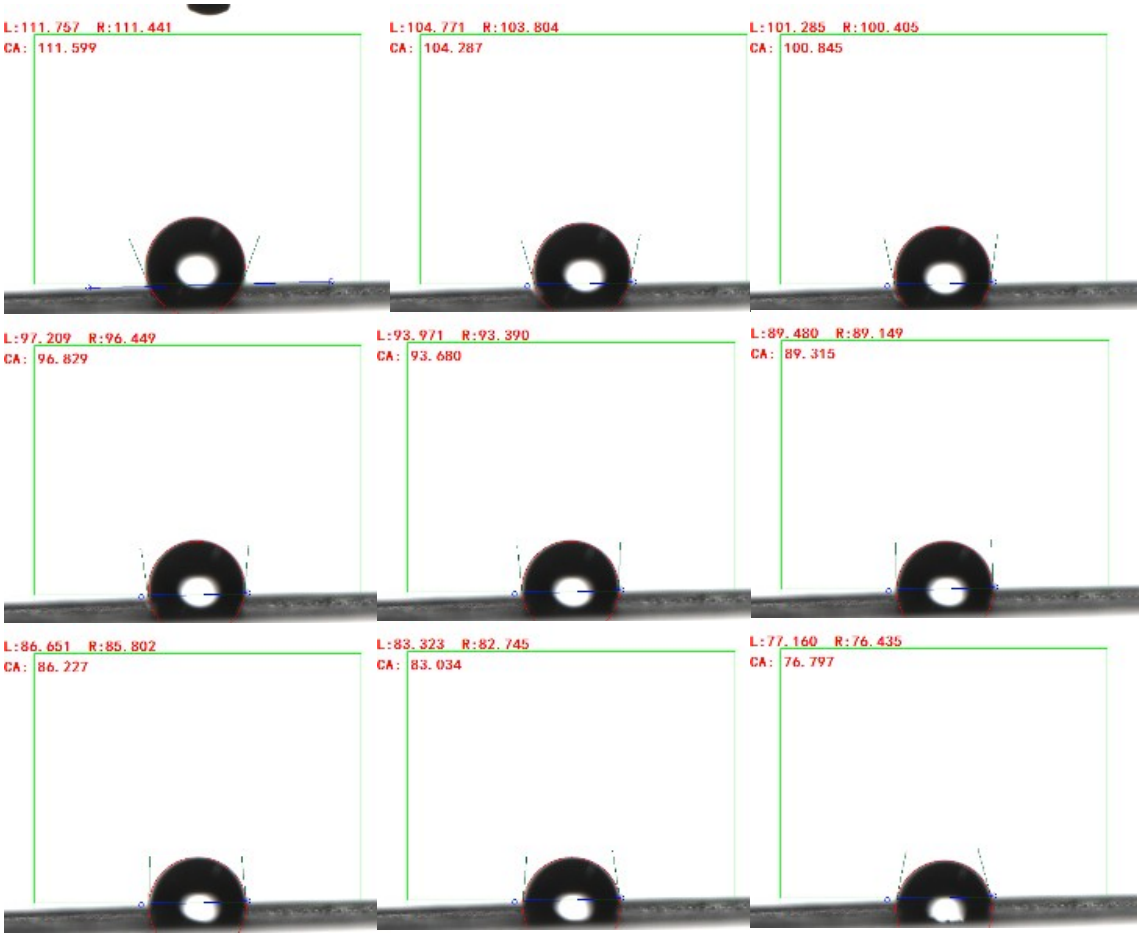


**Figure S3. The change process of the contact angle of PET interdigital electrode.**

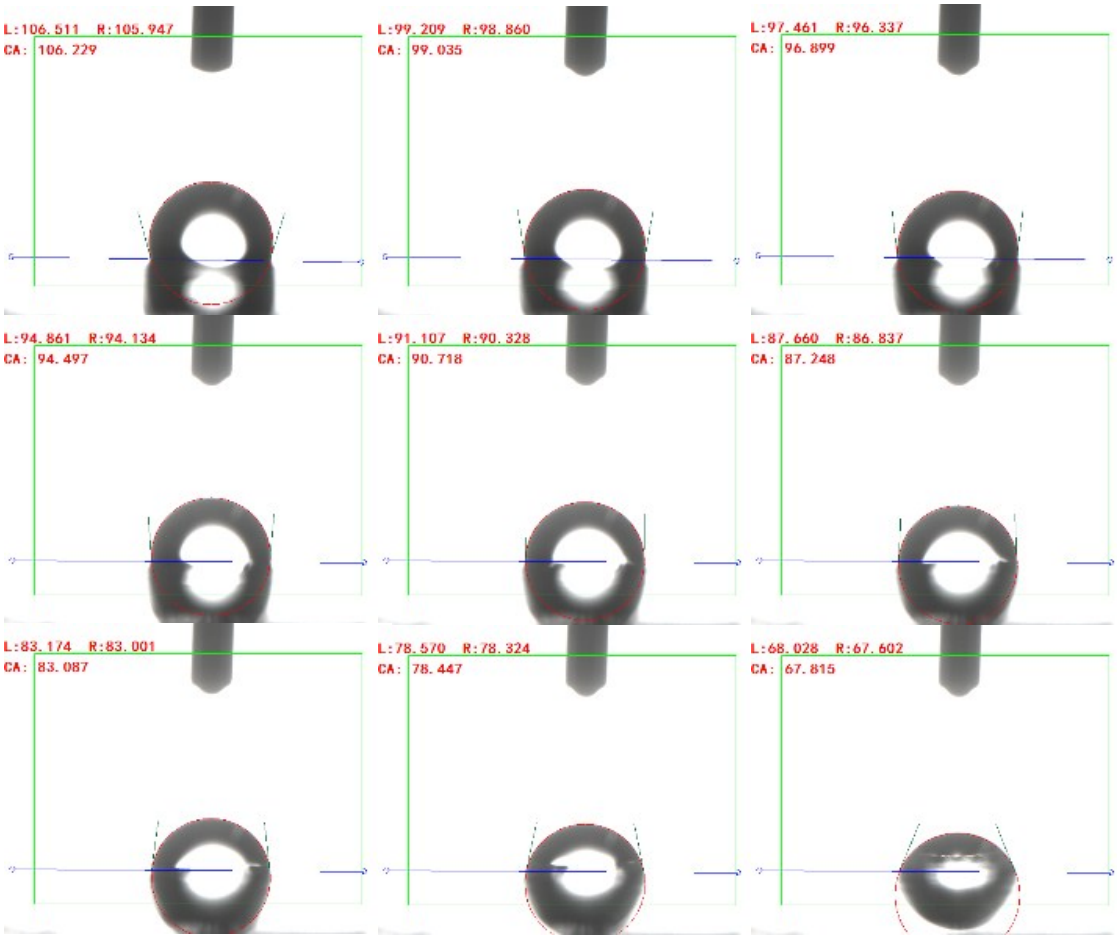


**Figure S4. The change process of the contact angle of ceramic interdigital electrode.**

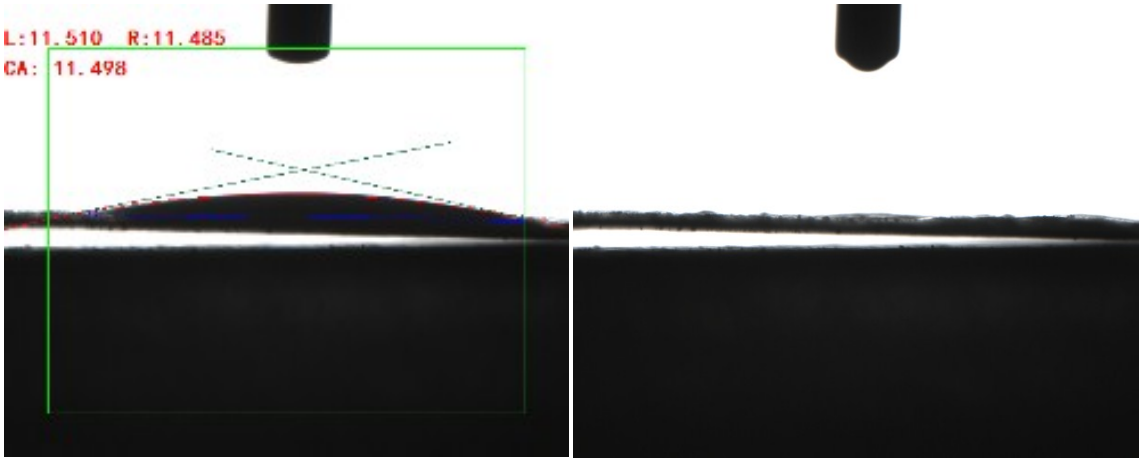


**Figure S5. The change process of the contact angle of $TaS_2$ nanosheets humidity sensor based on PET with 50% sample adhesion rate.**

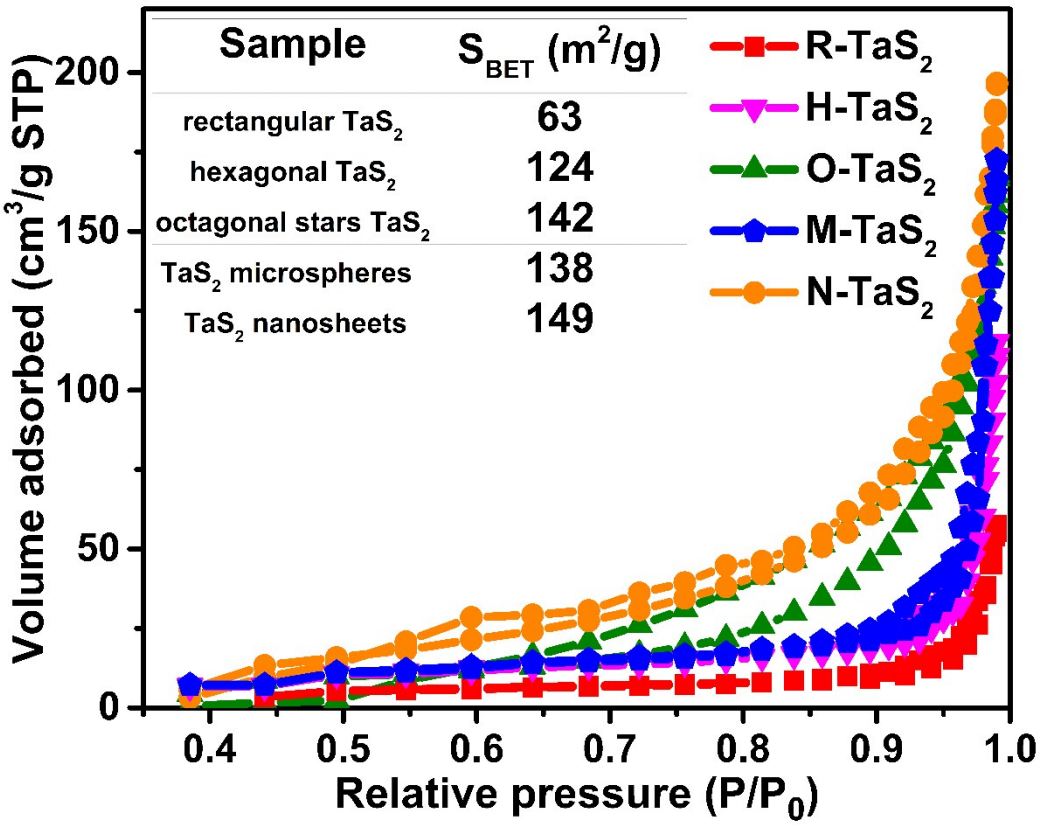


**Figure S6. $N_2$ adsorption–desorption isotherms of R-$TaS_2$ (rectangular $TaS_2$), H-$TaS_2$ (hexagonal $TaS_2$), O-$TaS_2$ (octagonal stars $TaS_2$), M-$TaS_2$ ($TaS_2$ microspheres), and N-$TaS_2$ ($TaS_2$ nanosheets).**

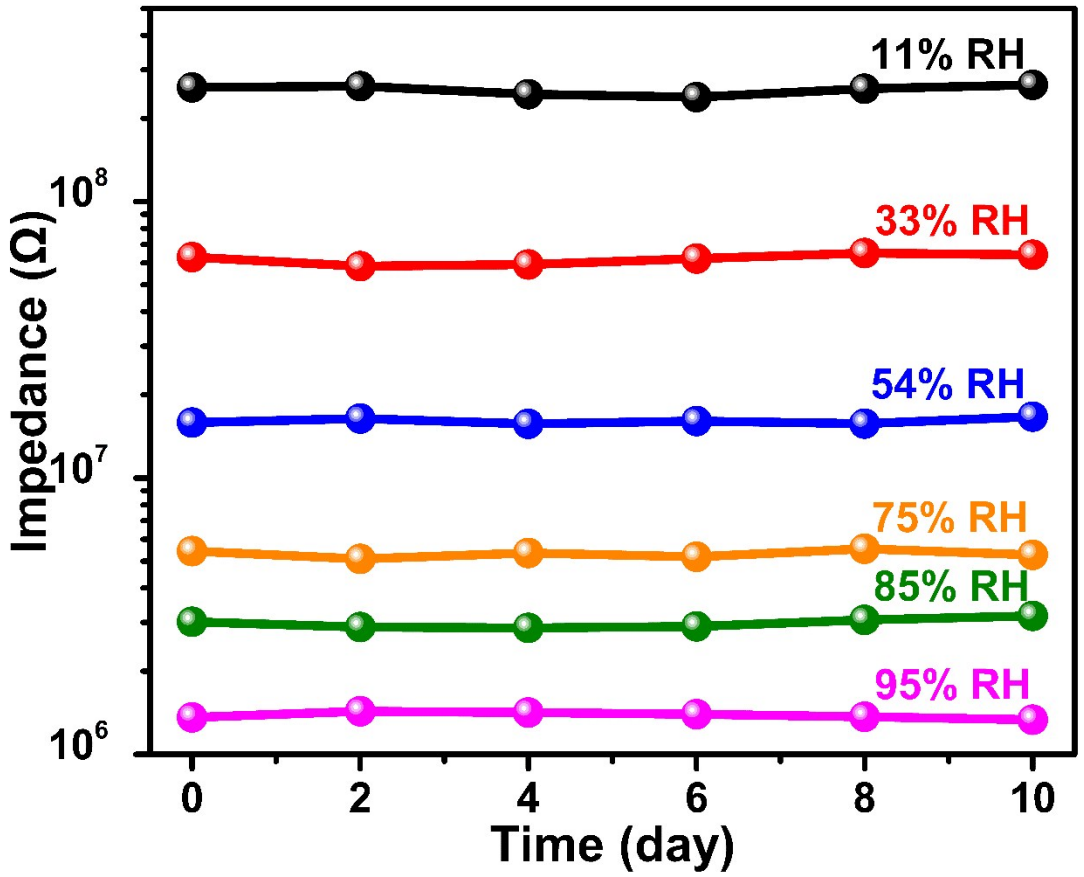


**Figure S7. The response of $TaS_2$ nanosheets sensor monitored at different humidity conditions for 10 days.**

**Table S1. Comparison of $TaS_2$ based humidity sensor with other humidity sensors reported.**

| Material | RH range (%) | Order of impedance change | Sensitivity (%) | Hysteresis (%) | Response Time (s) | Recovery Time (s) | Reference |
|---|---|---|---|---|---|---|---|
| **Black Phosphorus** | 11-97 | 3-4 | 507825 (ΔC/C) | - | 4.7 | 3 | S1 |
| **$MoS_2$** | 0-35 | 2 | $10^4$ | - | 10 | 60 | S2 |
| **$VS_2$** | 0-100 | 1 | 30 ($R_{RH}/R_{dry}$) | - | 40 | 50 | S3 |
| **$WS_2$** | 11-97 | 1 | 469 | - | 12 | 13 | S4 |
| **Graphene** | 50.0-70.6, 79.5-85.0 | - | -0.224, -4.118 (dB/%RH) | - | 4 | 23.7 | S5 |
| **Graphene oxide** | 10-90 | - | - | - | 0.03 | 0.03 | S6 |
| **$TaS_2$ nanosheets** | 11-95 | 2 | 201.9 (ΔR/R) | 0.02 (75% RH) | 0.6 | 2 | This work |

## References

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