Supplementary Materials

The following is the manufacturing process of the device. The flow chart is shown in Figure S1.

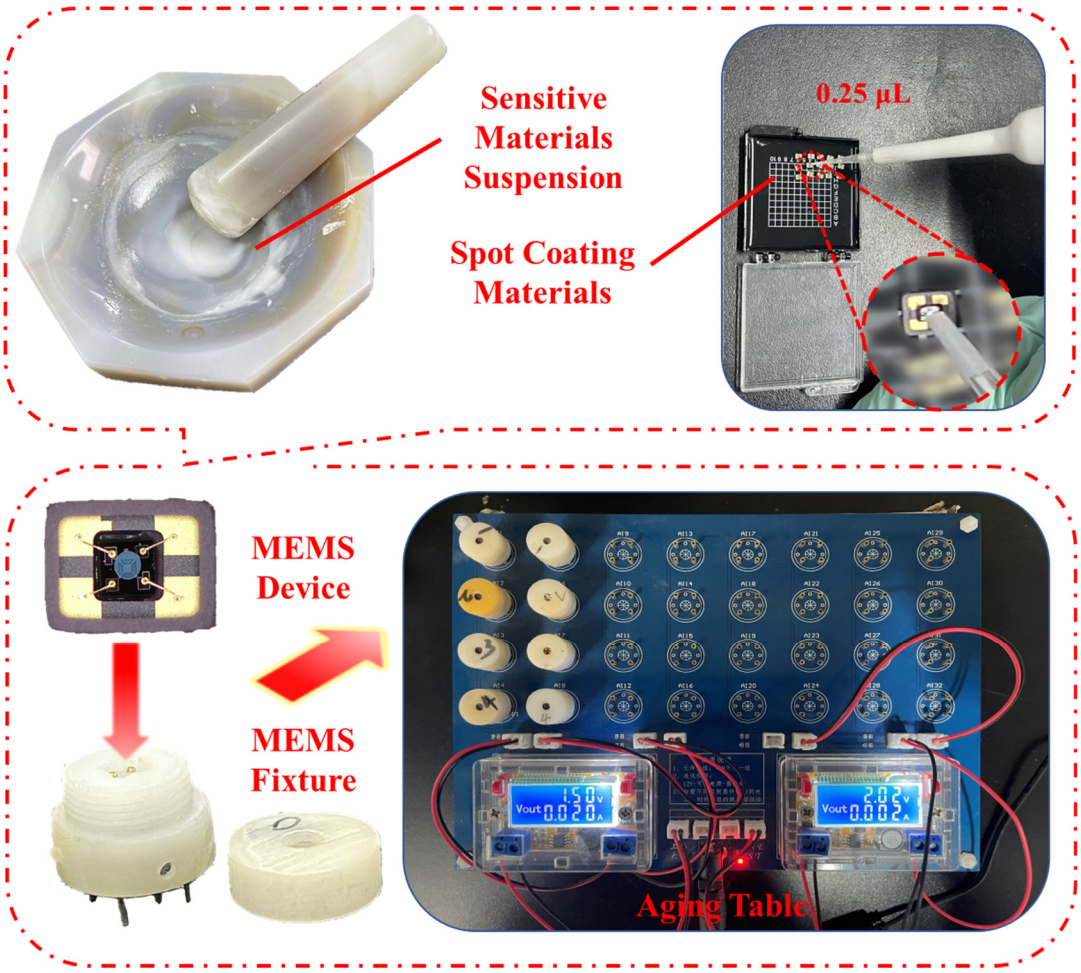

Figure S1. MEMS gas sensor preparation flow chart

Firstly, 50 mg of sensing material and 0.5 mL ethanol were put into a mortar, and ground them for 10 min. Then another 0.5 mL ethanol was droped into the mortar and continuously ground for 10 min so as to obtain a suspension with uniform components.

In order to ensure the consistency of the prepared devices, five 0.25 μL suspension with a pipette gun was droped onto the electrode of MEMS devices. The coated MEMS sensors were dried under the infrared lamp for 6 h, then put them into a fixture and aged on the fixture for 7 days before testing.

P/P_0 is the relative pressure, V_m is the saturated adsorption capacity of the single layer, and N_A is the Avogadro constant($6.023 * 10^{23}$ /mol), σ_m is the area of each nitrogen molecule on the adsorbent surface($16.2 * 10^{-20}$ m^2), C is a constant, Q is the adsorption capacity under the current relative pressure.

According to the multi-layer adsorption theory proposed by Brumauer, Emmett and Teller, the equation is obtained:

$$\frac{P}{Q(P_0 - P)} = \frac{1}{C} + \frac{C-1}{V_m C} * \frac{P}{P_0} \quad (1)$$

When P/P$_0$ is in the range of 0.05-0.25, a straight line between P/P$_0$ and Q can be obtained, with slope $\frac{1}{V_m}$ and intercept $\frac{C-1}{V_m C}$. The calculation formula of SSA is as follows:

$$SSA = V_m * N_A * \sigma_m \quad (2)$$

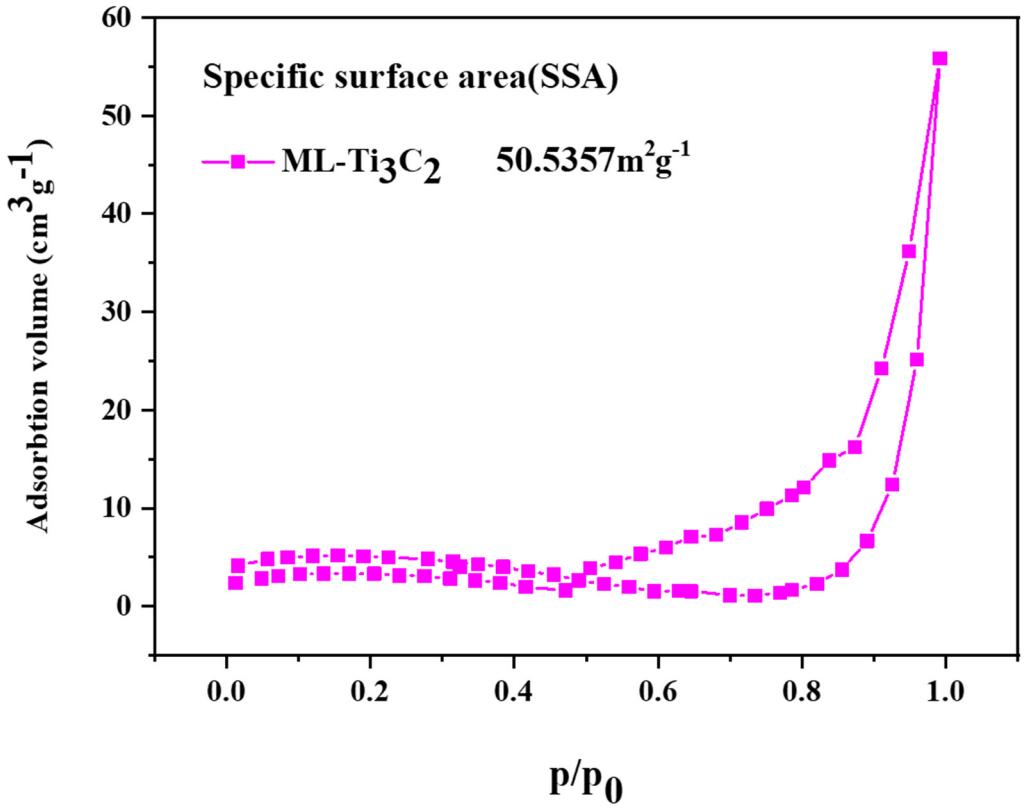

Figure S2. Nitrogen adsorption desorption isotherms of ML-$Ti_3C_2T_X$