

Supplementary information for

Laser speckle grayscale lithography: a new tool for fabricating highly sensitive flexible capacitive pressure sensors

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S1. Structural uniformity

The engineering diffuser (ED1-S20, Thorlabs) in the exposure system can provide a uniform laser speckle exposure light field and consistent microstructures. Figure S1 illustrates the exposure area of 11×11 mm on a 1-inch wafer coated with photoresist and the microstructures in different positions. After photoresist development, we selected four different positions (I, II, III, IV) within the exposure area for microstructure characterization through SEM. The distance between two adjacent sampling positions was approximately 2.2 mm. It can be observed that, overall, there is almost no variation in the morphological features of the microstructures at different positions, indicating uniform laser speckle exposure light field and consistent microstructures.

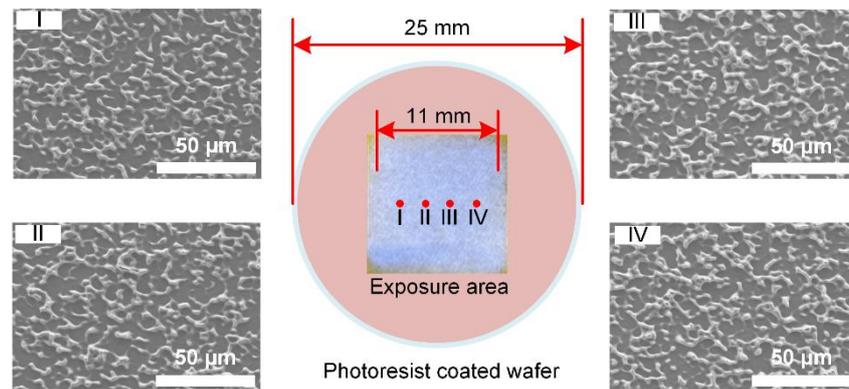


Fig. S1 A layer of photoresist was spin-coated on a 1-inch wafer, with an exposure area of approximately 11×11 mm. After developing the photoresist, four positions (I, II, III, IV) within the exposure area, as shown in the figure, were selected for SEM characterizations.

S2. The impact of external environmental and mechanical deformation on the sensor

As shown in Fig. S2a, when the humidity increases from 20% to 90%, the relative capacitive variation of the sensor remains nearly unchanged, indicating that the sensor is not affected by humidity. As illustrated in Fig. S2b, when the temperature steadily rises from -9 °C to 53 °C, the relative capacitive variation of the sensor decreases by approximately 0.1. As depicted in Figs. S2c-e, when the sensor is subjected to stretching, bending, or twisting, the greater the deformations, the larger the relative capacitive variations.

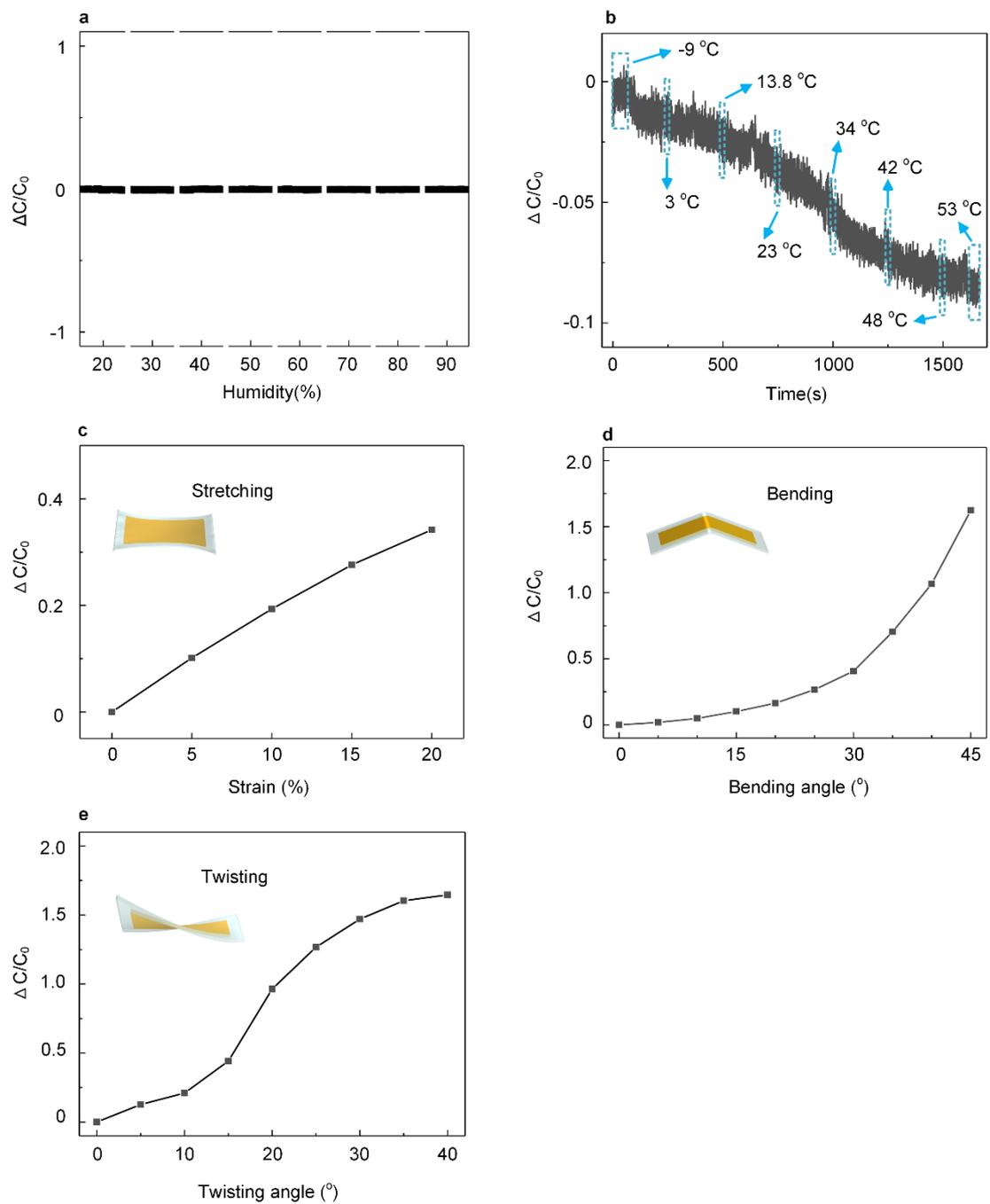


Fig. S2 The impacts of external environmental factors and mechanical deformations on the sensor. **a** humidity, **b** temperature, **c** stretching, **d** bending, and **e** twisting.