Electronic Supplementary Material (ESI) for Nanoscale Horizons.


# Supporting Information

**Microelectromechanical system for in-situ quantitative testing of tension-compression asymmetry in nanostructures**

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**MEMS-based mechanical testing system**

The details of the developed MEMS-based mechanical testing system are shown in Figure S1, which can be divided into three modules: MCU, ADC and MEMS development board. Compared to the previously designed integrated test boards [1], this modularized scheme and commercial MCU modules are compatible with different types of MEMS devices, resulting in a significant increase in experimental efficiency and fault tolerance.

When the system is operating, the control signals of the MCU are input to the corresponding ports of the ADC and MS31110 chips through the line to configure the operating modes. The wire-bonded MEMS device and MS3110 chip are integrated into a MEMS development board to reduce the ambient noise. The MS3110 chip is used to convert capacitance changes from differential capacitance sensor into analog voltages. The analog output voltage is collected and converted into a digital signal through the ADC module and transmitted to the PC in real-time through the serial port of the MCU. Through the conversion formula, the voltage change can be converted into the displacement change of the sensor, and the mechanical properties of the nanostructure can be further obtained.

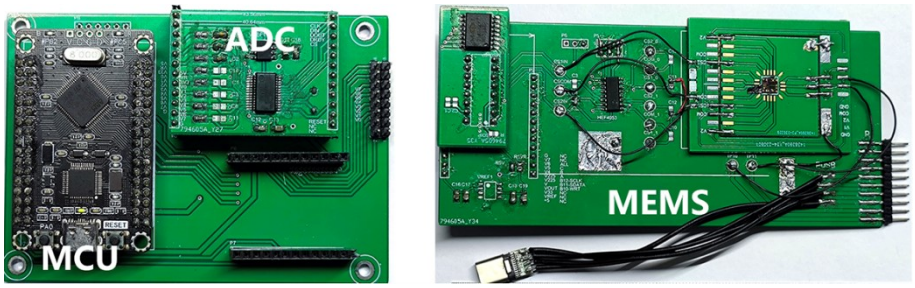


Fig.S1 The components of the MEMS-based *in-situ* quantitative mechanical test system.

REFERENCES:

1. Y. Huang, M. Nie, B. Li, B. Wu, A. Zheng, K. Yin and L. Sun, *IEEE Sensors Journal*, 2023, **23**, 22592-22599.