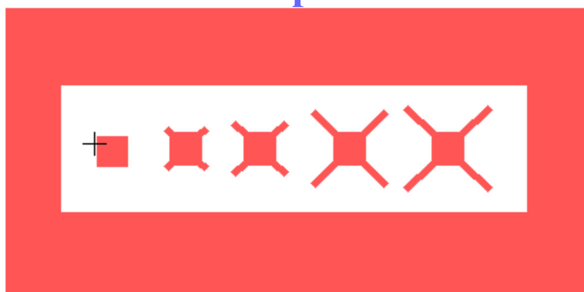
# Lecture 12 MEMS Device Testing

## Recommended testing items for the micro devices:

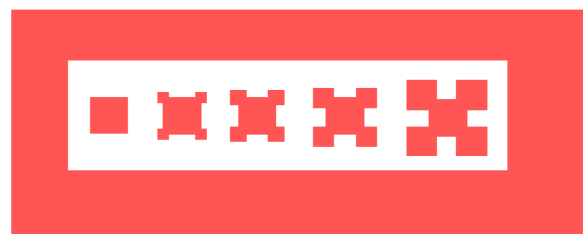
1. **Micro testing structure for bulk micromachining:**
   **The shape of testing structure vs. time**

### Corner Compensation 1



- Main square area length: 300 micrometer
- Corner width: 60 micrometer; length:

### Corner Compensation 2

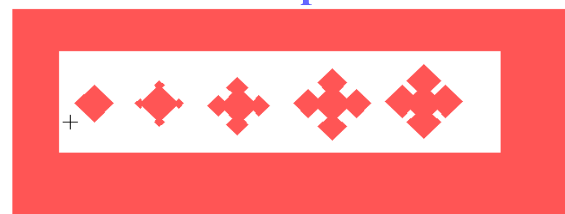


- Main square area length: 300 micrometer
- Corner area width: 80, 125,

### Corner Compensation 3

- Main square area length: 212 micrometer, diagonal length: 300 micrometer.
- Corner width: 40 micrometer;

### Corner Compensation 4

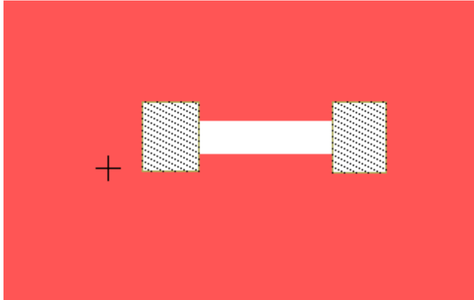


- Main square area length: 212 micrometer, diagonal length: 300 micrometer.

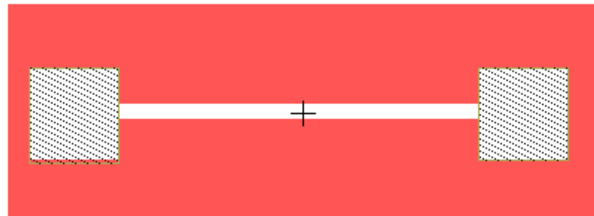
**2. Micro flow device:**

**Leakage, bonding strength, performance, visualization**

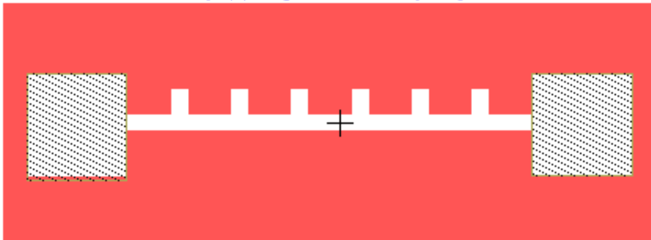
**Flow Channel 1**



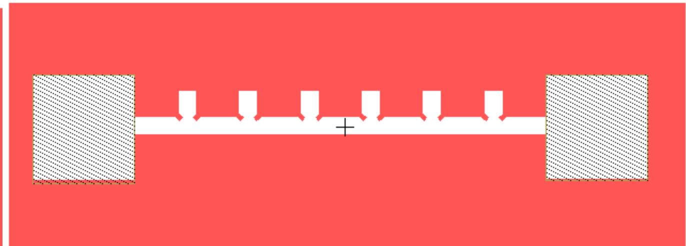
**Flow Channel 2**



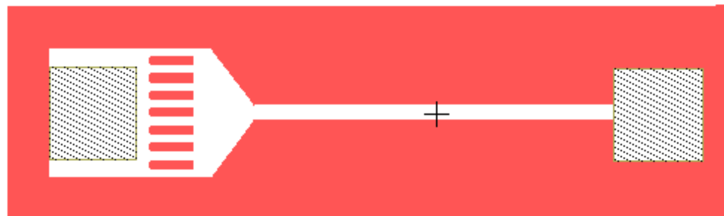
**Flow Channel 3**



**Flow Channel 4**



**Flow Filter**



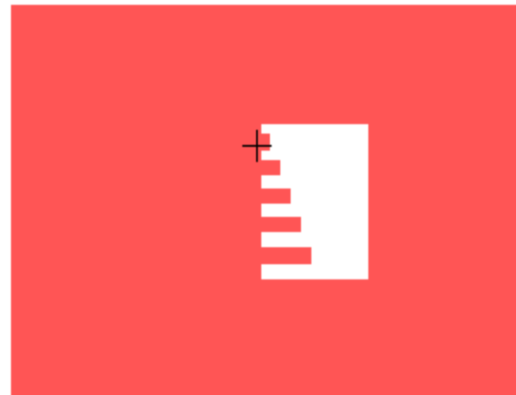
**3. Micro cantilever beam arrays:**

**Longest beam survived under IPA releasing procedure (possibility), deflection vs. applied force**

## Cantilever Beam 1

- Beam width: 20;
- Length: 40, 80, 120, 160, 200 micrometer
- Space between each beam: 20 micrometer.

## Cantilever Beam 2

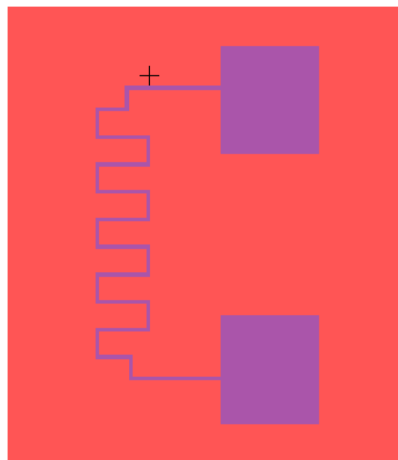


- Beam width:50;
- Length: 40, 80, 120, 160, 200 micrometer
- Space between each beam: 50 micrometer.

4. **Micro heaters and temp sensors:**

   **Measure the TCR of the sensor by leaving the sensor inside an oven with various temperatures and calibrate the sensor with a standard thermometer. In real temp measurement, apply current through heater and measure resistance change on the temp sensors close to the heater.**

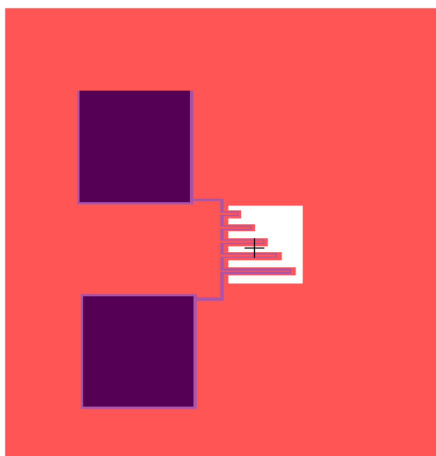
## Temperature sensor



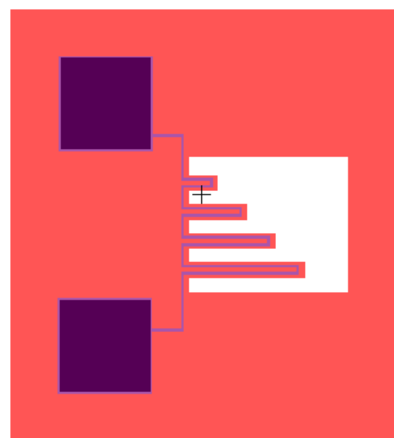
5. **Micro thermal actuators:**

   **Measure the deflection of cantilever beam under different currents.**

## Thermal Actuator 1

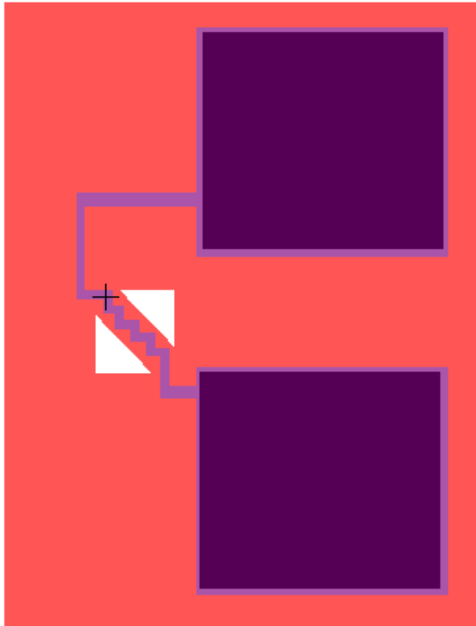


## Thermal Actuator 2

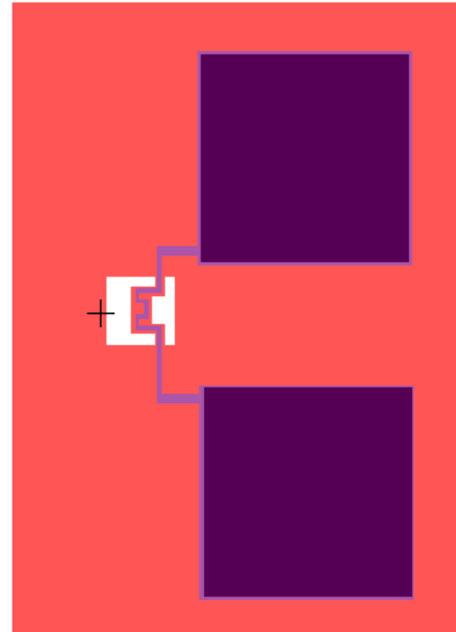


6. **Micro thermal flow sensor:**
   **Applied constant current and measure voltage change across the sensor under different wind blowing velocity.**

**Flow Sensor 1**

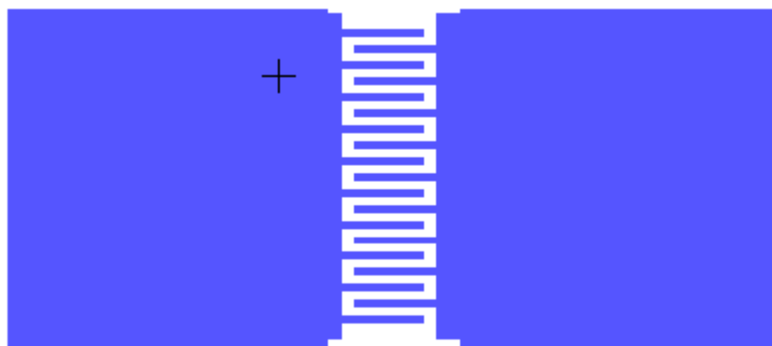


**Flow Sensor 2**



7. **Humidity sensor:**
   **Measure capacitance change under different humidity environment. (e.g. breathe over the sensor and see the change on capacitance)**

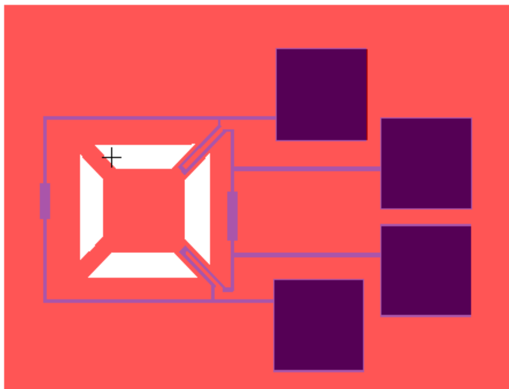
**Humidity sensor 1**



**8. Micro accelerometers/pressure sensors:**

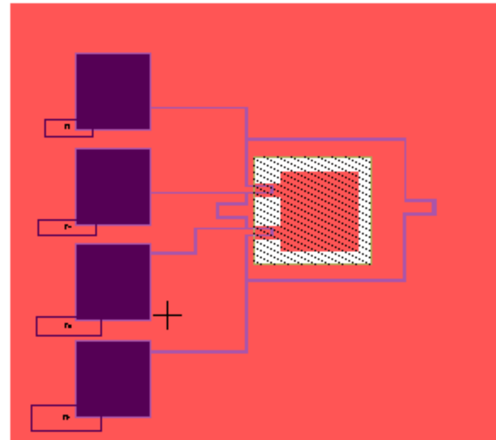
**Applied different loading/deflection on cantilever beam to measure resistance change of the sensor (the change of resistance can be measured by applying a voltage on the sensor and measure the change of voltage)**

## Accelerometer 1



- Mass area: 500 micrometer. (Width)
- Open space: 145 micrometer
- Support beam width: 100 micrometer;
- Support beam length: 245 micrometer.

## Accelerometer 2



- Mass area: 800 micrometer. (Width)
- Open space: 165 micrometer
- Support beam width: 125 micrometer;
- Support beam length: 250 micrometer.

# Final Report Specs

**0. Format and due date**
   - **a. In Chinese or English**
   - **b. With cover page containing course name, title of the report, instructor's name, your name, your department and student ID, date.**
   - **c. Text with 12 points, single space, single column, and figure treated as close to the explaining text as possible.**
   - **d. Submit your report by Friday, 1/11/2001 before 12:00 pm, both hard copy and e-file to my office, ESS 418. Also my email address: fangang@ess.nthu.edu.tw.**

**1. Objective**
   - **a. 1 paragraph**
   - **b. Specify what to learn and what is important**

**2. Procedure of process**
   - **a. 1-2 pages including figures**
   - **b. Using figures and short sentence to explain the process you have gone through in this course**

**3. Results and discussions of fabrication process**
   - **a. 2-3 pages**
   - **b. Specify which processes were easy without problem during the process and which had difficulty. Discuss the difficulty you have been through and describe how you solved the problems, or the suggestions, which can solve the problems.**
   - **c. If possible, redesign the processes and materials, which can be better suitable for making the same devices in this course.**

**4. Testing procedures of MEMS devices have been used in the class**
   - **a. 1-2 pages**
   - **b. Describe the methods you have used on the micro device testing, and the results you expect to see in the testing.**

**5. Results and discussions of testing**
   - **a. 2-3 pages**
   - **b. Discuss the results on the testing.**
   - **c. Please discuss whatever you saw on the device testing even the**

**device was not working. Describe how you know the devices are not good?**

**6. Conclusion**

**a. 1 page**

**b. Conclude what are successful or failed in the fabrication and experiment.**

**c. Conclude what you have learned in this course.**

**7. Reference**

**a. Leave any reference you have used in your report.**