EE143 MEMS Devices

General Comments:
MEMS devices were fabricated in the *identical* process as you performed in the EE143 lab. A XeF_2 etch was performed as the last step, to remove some of the Si substrate and free the oxide structures.

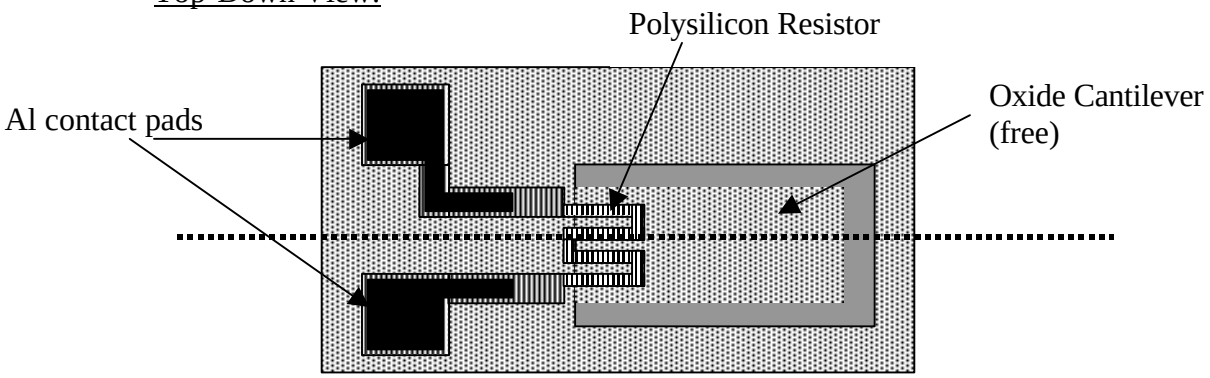
The structures are desribed below. **Note: The figures are not to scale.**

■ – Aluminum ▥ – Polysilicon ▩ – Oxide

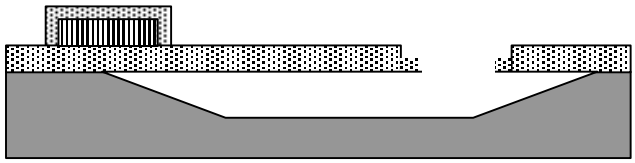
■ – Open to bare Si (patterned w/ ACTV and CONT)

1. Cantilever Beams

Top-Down View:



Cross-Section:

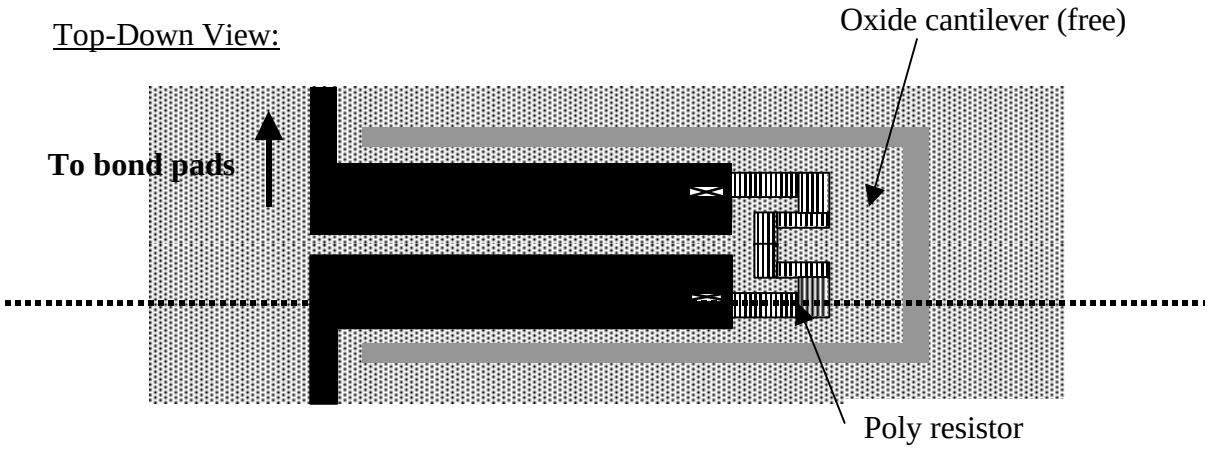


Explanation:

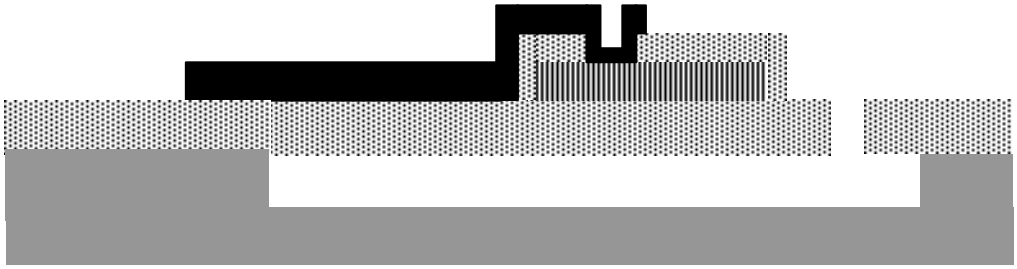
Silicon (and polysilicon) is piezoresistive. This means that the resistance will change as the material is strained. As you deflect the beam (with a probe tip) you strain the polysilicon resistor, and can measure the change in resistance. There are cantilever beams with a variety of lengths on the chip.

2. Thermal Bimorph

Top-Down View:



Cross-Section:

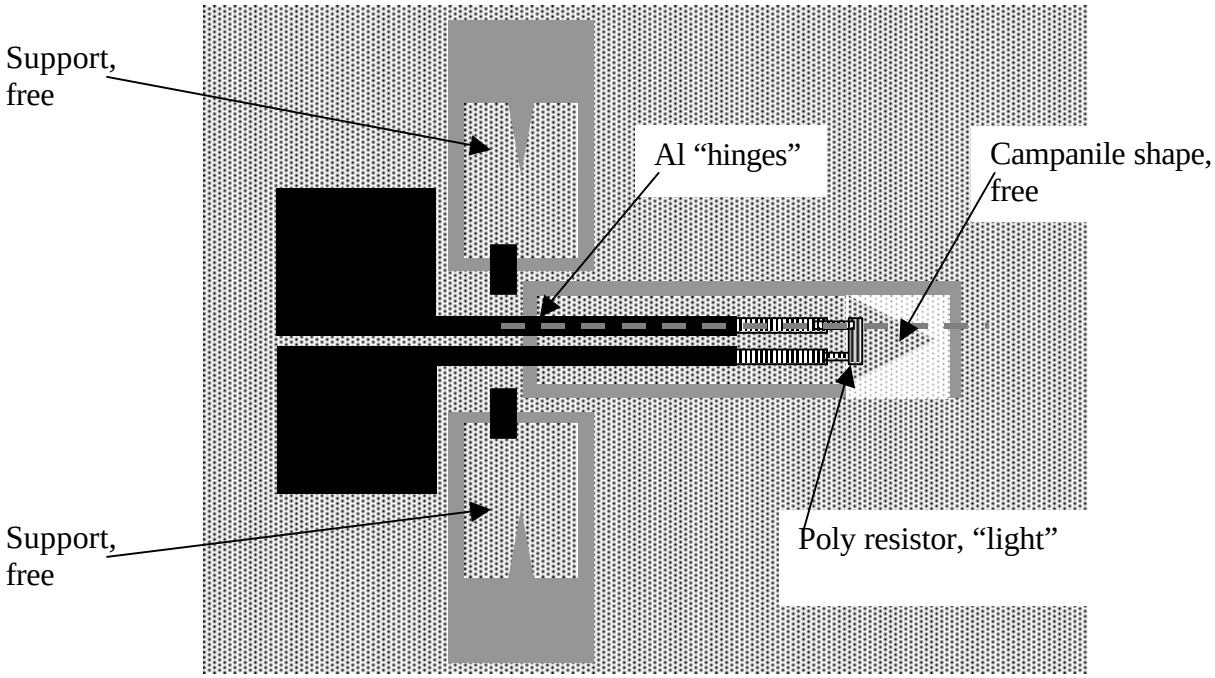


Explanation:

In this case, you will pass current through the polysilicon resistor, heating up the oxide cantilever. Large aluminum lines lie on top of the oxide cantilever. Oxide and aluminum have different thermal coefficients of expansion. The mismatch in expansion will cause the cantilever to deflect.

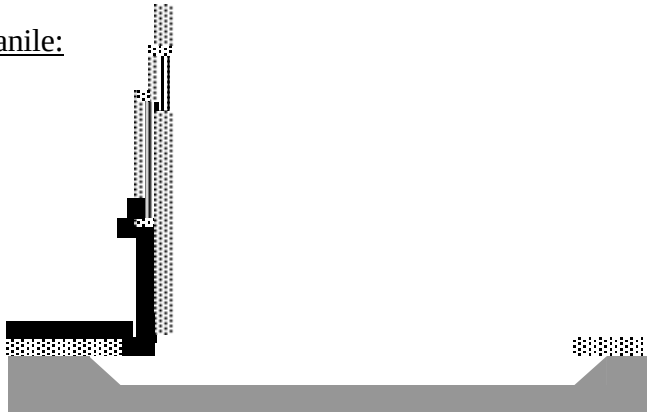
3. Campanile

Top-down View:



Cross-section:

Erected Campanile:

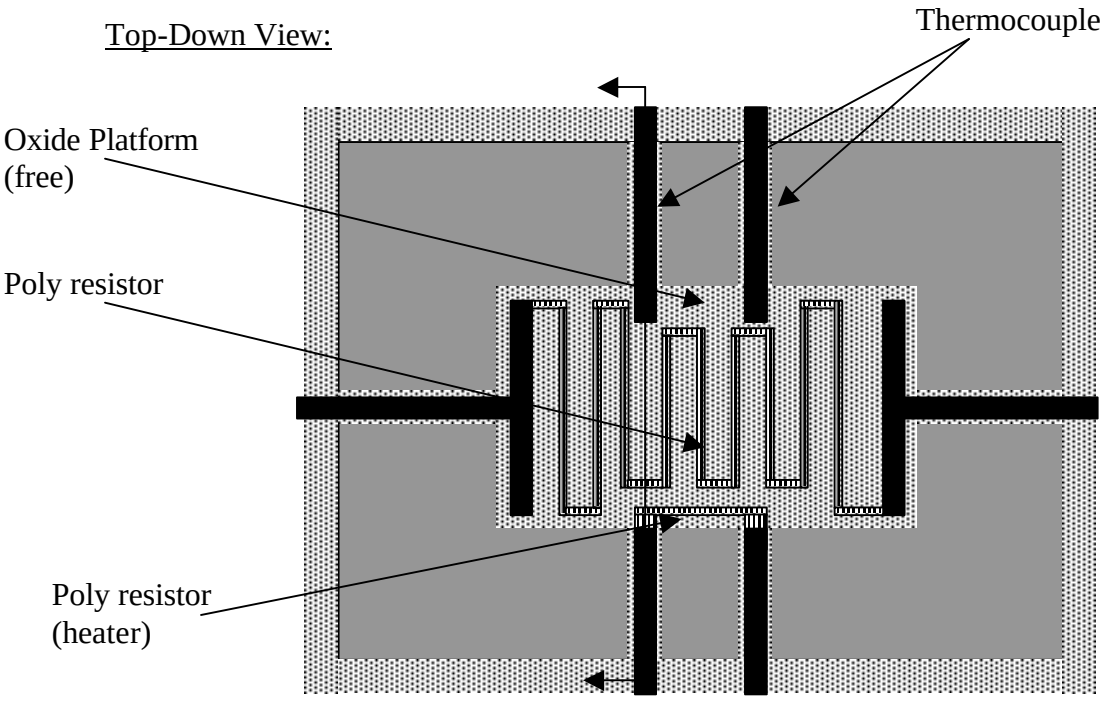


Explanation:

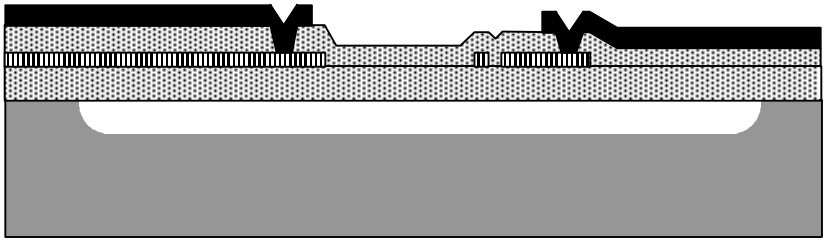
That's it. Using the probe tips, try to erect the campanile, bending the Al up. This can be quite difficult. Once erected, the two supports on the side can bend up to "lock" the campanile in place. Additionally, you can pass enough current through the polysilicon resistor to make the poly red-hot, giving the campanile a glowing beacon at the top.

4. Heat platform

Top-Down View:



Cross-Section:



Explanation:

Passing current through the resistor, you can heat up the oxide platform. This heat will result in two different properties to measure: a change in resistance from the resistor that stretches across the platform, and the voltage across the two terminals of the thermocouple will change. The thermocouple is basically a poly line below an aluminum line (separated by oxide). The poly and aluminum make contact at the end of the line. Heating this poly/Al junction is what causes the voltage change.