Design of a Micro Tension Test Device

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Abstract:
The goal is to design and microfabricate a device that can be used as a tension test tool for nanometer scale sample testing for in-situ scanning electron microscopy (SEM) experiments. The device will be capable of extracting the mechanical behavior of the nanometer scale samples, while still having full visual control on the region of the sample where the deformation of the nanometer scale sample evolves [1-3].

Summary of Research:
a. Current state of the studies: Currently, we are working on the integration of nanometer scale samples with the micro tension test devices. (See Figures 1 and 2.)
b. Challenges related with integration of nanometer scale samples and micro devices: Some of the challenges are the following:

i. The adhesion forces: The adhesion forces between the silicon-chromium, and chromium-gold layers should be sufficiently strong so that no fracture or delamination occurs.

ii. Release of the devices: There may be some difficulty in releasing the device layer from the underlying oxide layer.

iii. Control of critical dimension: As the critical dimension gets smaller and smaller, the control of this dimension becomes more difficult with conventional optical lithography techniques. Thus we will have to address this issue as we continue the device development.

References:

Figure 1: Full view of one of the incomplete devices on an SOI wafer.
Figure 2: Closer view to the electrostatic actuator and capacitive displacement sensor region.