Abstract:
The devices that we are considering in our design are actuated with electrostatic comb-finger actuators. The strain and force on the specimen are calculated from the observation of the deformation of the mechanical springs which are attached to both sides of the dog bone specimen. While one of the mechanical spring set can be used to obtain the applied force value, the difference between the deformations of the two sets of the mechanical springs can be used to obtain the strain value of the specimen.

Summary of Research:

a. Initial design: Before we start working on the complete design, we concentrated on critical issues related with the functionality of the tension test device. In this phase, we work on a “1-mask process flow” device. By doing that, we isolated the structure form the difficulties related with the coming steps of the process, and we intended to see whether the designed electrostatic comb-driven structures are sufficient for our purposes. Our purpose is to use the ultimate optimized device as a micro tension test device to measure the mechanical properties of specific materials at nanometric scales. Figure 1 shows the main components of one of the initial design devices.

b. Actual devices from the first microfabrication batch: Figures from 2 to 4 are optical micrographs of the devices. Figure 2 shows one of the actual devices under an optical microscope. Figure 3 shows a zoomed view of one of the force sensors. Figure 4 is a zoomed view of figure 3, and shows the mechanism that will be used as a displacement measurement tool in our design [1].

c. Current studies: Currently, we are working on the integration of nanometric scale samples with the micro tension test devices. The researcher working in this project is currently at CNF and he is taking training courses related with the operation of the tools that are required for the integration of nanosamples with the micro tension test devices.

References:
Figure 1: A solid 3D view of one of the devices in the mask.

Figure 2: One of the complete devices on the wafer.

Figure 3: Force sensor and the displacement measurement tool.

Figure 4: Zoomed view of the displacement measurement tool of the device.