Microscale tensile tester

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The goal of this project would be to design a microscale device that can enable tensile tests to be carried out on an integrated microscale polymer sample. The device must be able to exert a known amount of force and measure the strains produced on the sample. The basic tasks of this project would include design of suitable actuation/sensing mechanism, patterning of the polymer sample and demonstrating ability to make measurements. Small scale samples are desirable to study scaling effects and also to use less of a "precious" or rare material. Typical tensile testers are not ideal for making measurements on small samples.

For example, SU-8 is a UV curable polymer originally designed as a photo resist. Due to its structural properties, it has gained wide spread use as a structural material for MEMS. Its relatively soft mechanical properties and biocompatibility, makes it a promising material for biological sensors. One of the attempts in this direction is to modify its electrical properties by introducing nano-particles (CNTs, diamondoids, etc.) in the polymer. The ability to increase the electrical conductivity by such processes has been demonstrated.[1-3] The piezoresistive properties of such a material need to be characterized in order to use it for sensor applications. However, the mechanical properties of SU-8 are not well characterized at these scales.

One of the main challenges foreseen is a suitable means to pattern and anchor the polymer sample on the tester. Other aspects would include calibration of generated forces and the strain sensor. Future directions to be kept in mind would be the incorporation of electrodes for simultaneous measurement of sample resistance.

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