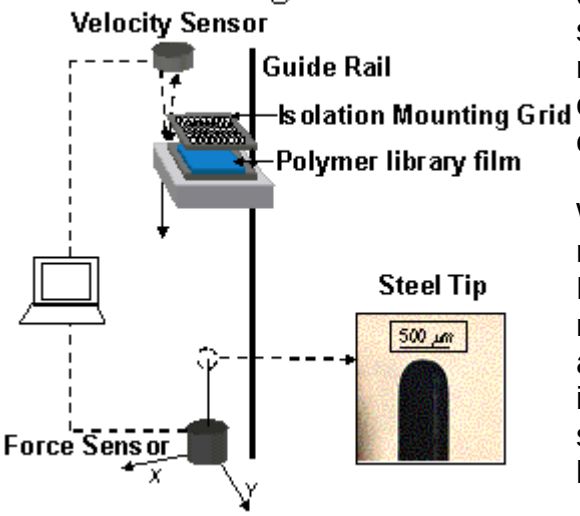
High-Throughput Mechanical Property Measurements - Meredith

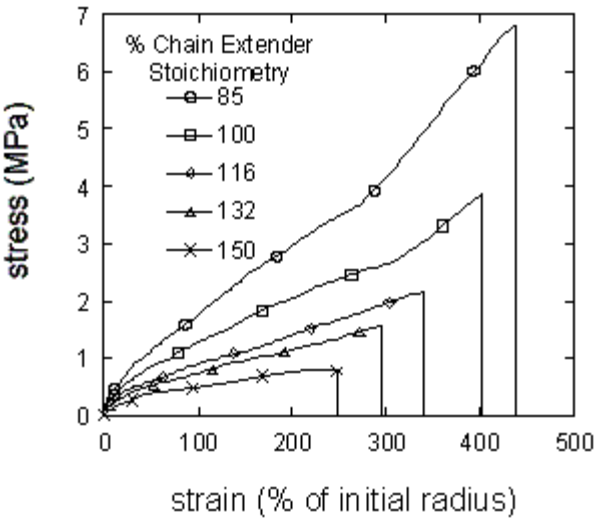
One of the most time-consuming and expensive tasks in polymer materials development is the measurement of mechanical properties, and their correlation with chemical and physical properties. The methods of combinatorial chemistry and high-throughput screening have improved efficiency and lead to major discoveries in drug discovery and catalysis, but these techniques have not been extended into the realm of polymer mechanics.

Figure 1



We have developed a novel high-throughput mechanical characterization apparatus, called HTMECH, illustrated in Figure 1. The goal is not to replace conventional detailed mechanics and fracture measurements, but rather to introduce a new high-throughput mechanical screening tool that allows measurement of hundreds of compositions, temperatures, and strain-rates in as little as a few hours. We couple the mechanical measurements with high-throughput AFM and FTIR measurements to develop structure-mechanical property correlations. Figure 2 shows stress versus strain data forpolyurethanes on a composition-gradient library, where the composition of chain extender is varied. We have demonstrated recently that our HTMECH apparatus, although very different in deformation mode and scale from conventional instruments, yields modulus data that are in good agreement with conventional Instron tensile tests.

Figure 2



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