Polymer Characterization

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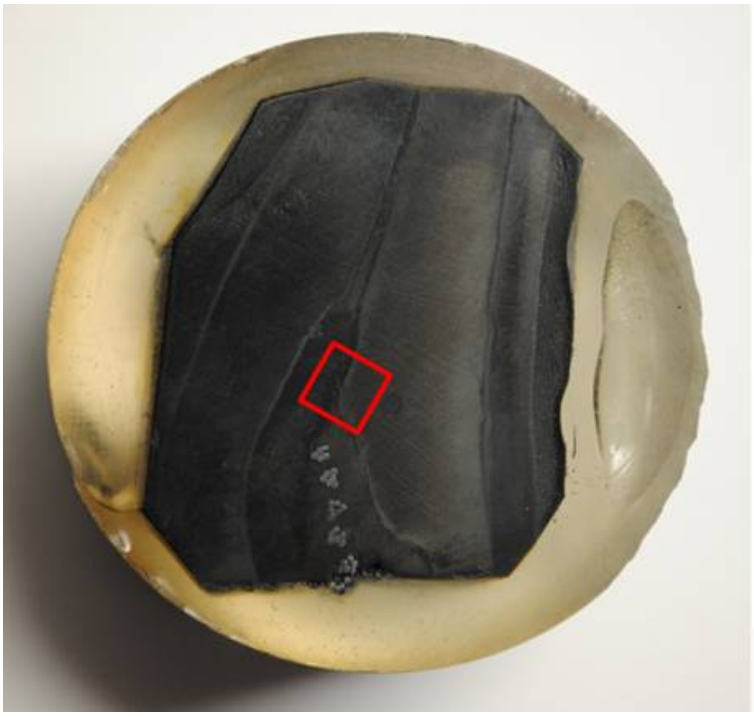

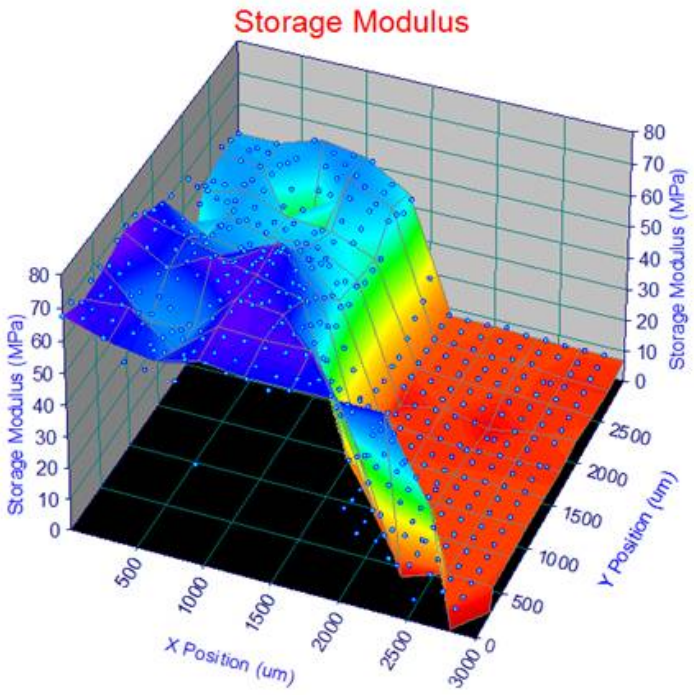

The primary advantage of using nanoindentation for characterizing polymers is spatial resolution! When performed correctly, a nanoindenter can be used to very accurately characterize the complex modulus of polymer materials in small sample volumes; such as on the cross-section of a sample or chemically modified surfaces. The storage and loss modulus of materials from several kPa to hundreds of MPa can be readily measured using a nanoindenter. In most cases, polymers with approximate storage moduli under 500 MPa are characterized using a flat punch indenter tip that is selected to provide a good measurable stiffness; therefore, the softer the polymer, the lower the resolution.

Using the Universal Tensile Machine (UTM) for polymer characterization provides the ability to continuously study storage and loss modulus during evolving strain conditions. Dynamic properties are evaluated continuously while the sample is subjected to a constant strain rate test, providing the most accurate form of dynamic characterization for sample evaluation. This is critical in the evaluation of micro-fibers and samples with limited cross-sectional area that are subjected to macro-strains such as polymer heart stents and fibers for energy absorption.

Two example reports that highlight the advantages of polymer characterization using nanoindentation are provided below. The O-ring report shows the advantages for measuring chemically modified surfaces, while the tire cross-section report shows the advantages of high X-, Y - spatial resolution for polymer composites. In both of these

examples, traditional bulk characterization would have provided a convoluted response; for the O-ring sample it would have been a convoluted response of the unmodified inner region with the chemically modified surface, and for the tire-cross-section it would have been a convoluted response of all of the polymer layers.