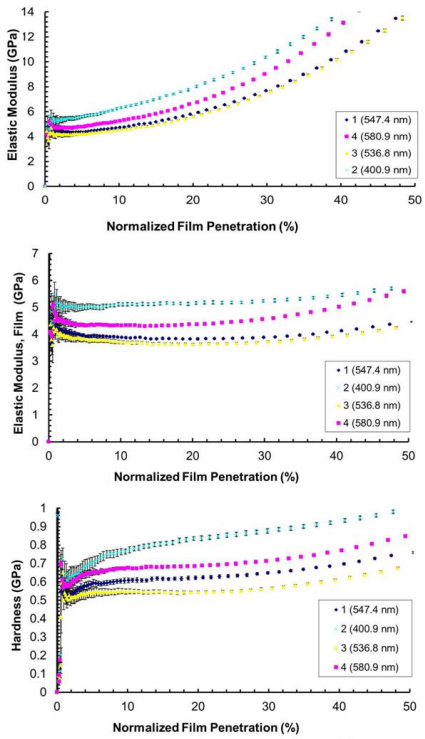
Thin Dielectric Films

Print

You can leverage the extensive expertise at the Nanomechanics' Analytical Services Laboratory in the mechanical characterization of ultra-thin films to evaluate and improve the mechanical integrity of your dielectric thin films. Our high throughput and quick turn around time allows combinatorial studies to be efficiently completed so that processing parameters can be optimized. Our labs use multiple techniques for mechanical characterization including dynamic nanoindentation testing with the Continuous Stiffness Measurements (CSM) technique, quasi-static nanoindentation with ultra-low force capabilities, and unmatched low force scratch testing that uses scratch tips designed for testing ultra-thin films.

Nanoindentation of Dielectric Thin Films



Two techniques are commonly used to analyze the hardness and elastic modulus of thin films - dynamic and quasi-static nanoindentation. There are fundamental differences in the way these tests are conducted, but similar results can be obtained in the end with a profile of hardness and elastic modulus as a function of penetration into the film. Samples of the graphical and tabulated results from each technique are provided below.

Continuous Stiffness Measurement Technique (CSM)

Dynamic indentation is completed using the Continuous Stiffness Measurement (CSM) technique which allows the evolution of mechanical properties to be observed as the indentation tip penetrates the film at a constant indentation strain rate. This technique allows the most complete information about surface properties through to the substrate. Nanomechanics' even uses algorithms that accurately account for substrate influences allowing you to evaluate the properties of your films up to 40% of penetration.

More information about the measurements of the mechanical properties of thin dielectric using the CSM technique can be found in multiple sample reports on our website. Nanomechanics conducts a lot of research around the best measurement techniques for the determination of thin film mechanical properties and will bring you the most advanced technology in measuring thin film mechanical properties.

Sample	Elastic Modulus, Film (9.5% to 10.5%)	Elastic Modulus, Film St Dev.	Hardness (9.5% to 10.5%)	Hardness Standard Deviation	Minimum Elastic Modulus	Minimum Modulus Standard Deviation	Minimum Hardness	Min Hardness Standard Deviation
	GPa		GPa		GPa		GPa	
1 (547.4 nm)	3.89	0.03	0.61	0.01	4.33	0.07	0.58	0.02
2 (400.9 nm)	5.11	0.06	0.77	0.01	5.67	0.13	0.71	0.03
3 (536.8 nm)	3.71	0.06	0.55	0.01	4.19	0.13	0.53	0.02
4 (580.9 nm)	4.32	0.03	0.67	0.01	4.72	0.09	0.64	0.02