Confocal Laser Scanning Microscope (CLSM)

Specifications and Features

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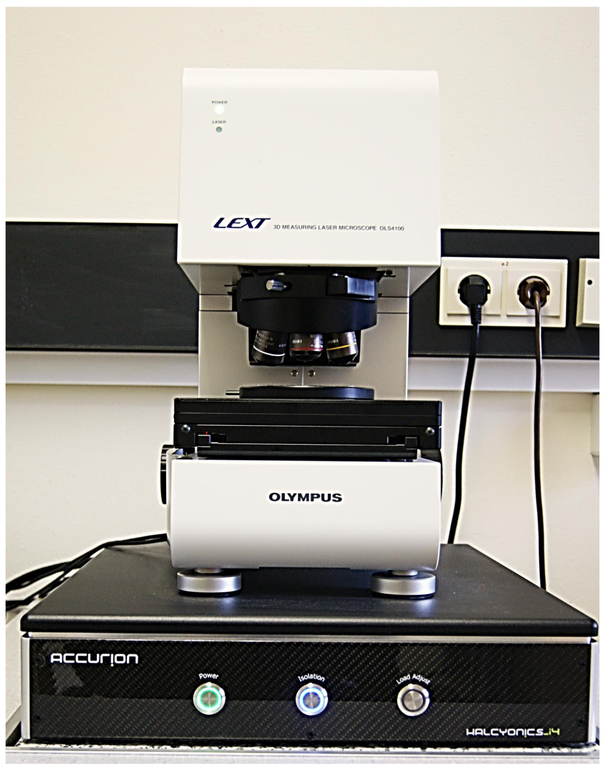
- Objective Lens Magnification: 5x to 100x
- Laser 3D image Magnifications: 20X to 100X
- Digital Magnification: 1 to 8x
- Total Magnification capability: 5x to 17,280x
- Color Imaging Mode: White LED Light
- Laser Imaging Mode: 405 nm Laser (violet), Photomultiplier Detector
- Minimum Z-Resolution: 10 nm
- Minimum XY-Resolution: 120 nm

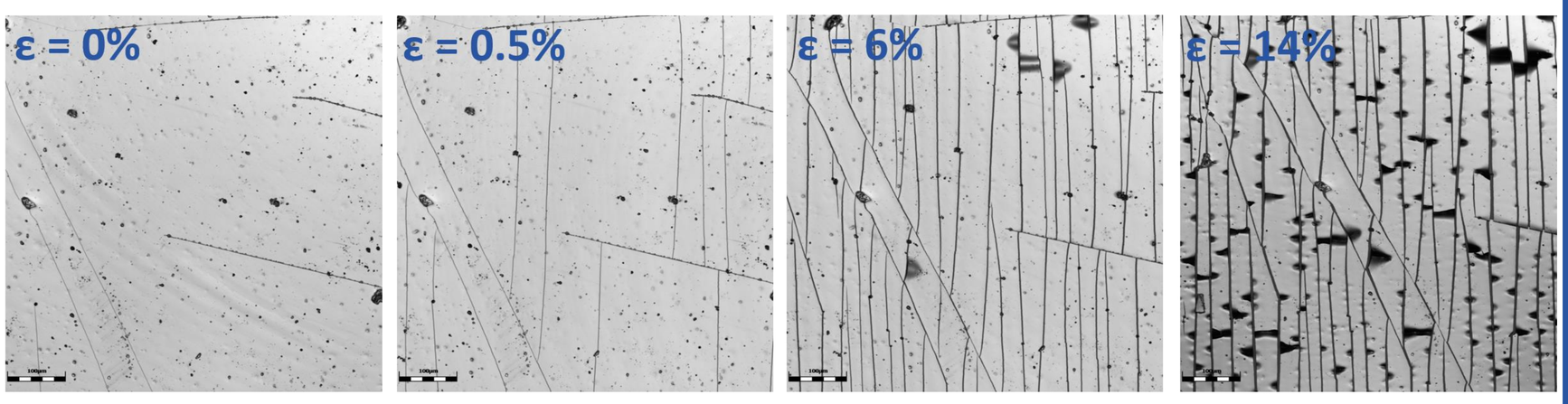


Features:

- Optical, laser and 3D-images
- Stitching mode
- Image correction in software available
- Software includes data analysis (thickness, profiles, roughness, particle analysis)
- Differential image contrast (DIC) enhance contrast with a prism for optical images
- High resolution mode (4K)

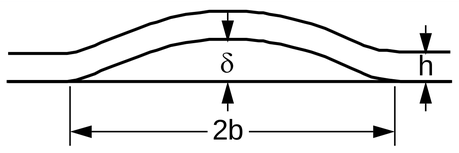
In-situ Fragmentation Testing with CLSM

- Images made with CLSM laser to more clearly view the cracking and delamination
- Determine the crack spacing evolution of a film as a function of strain
- Measure adhesion using the delaminations (see below)

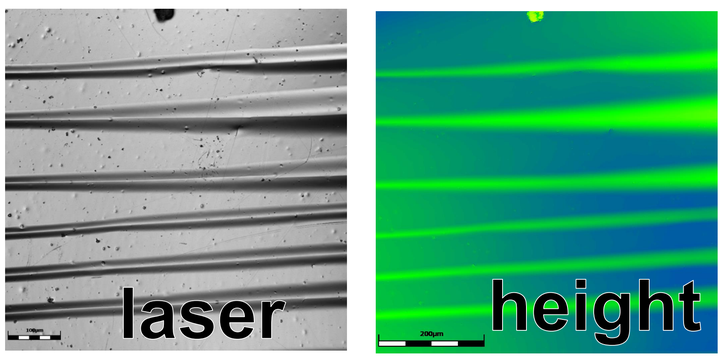


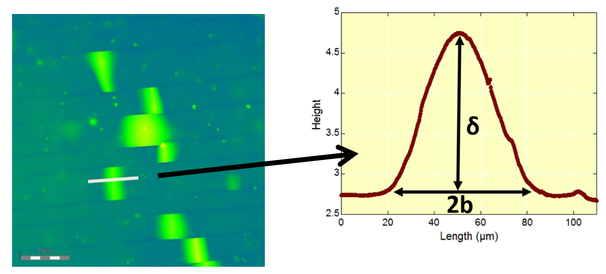
Measuring Adhesion with CLSM

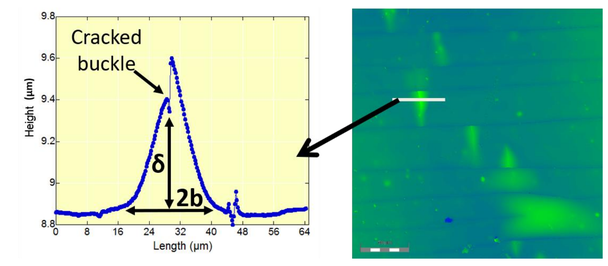
- CLSM height images can be used to measure the dimensions of delaminations (buckles)
- Buckle height, δ, buckle width, 2b, and film thickness, h, are needed to calculate interface adhesion energy
- Large buckles (over 1 µm in height) can be measured with CLSM compared to AFM which can only be used to measure small buckles
- Less time is needed to measure more buckles – better statistics in calculated values!



Buckle Cross-section

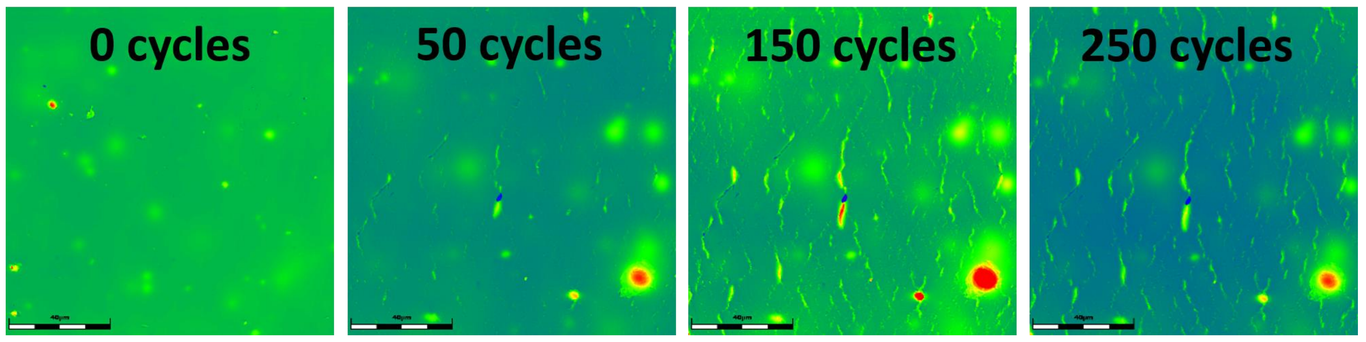


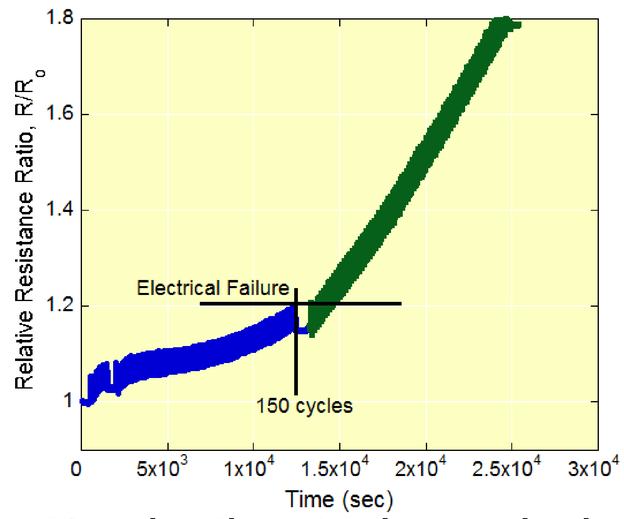




In-situ² Fatigue Testing with CLSM

- Combine resistance measurement into grips to provide information about the electro-mechanical behavior
- Determine failure as a function of cycle number and electrical conductivity
- Observe formation of extrusions and cracks to better understand electro-mechanical failure





After 150 cycles, the extrusion spacing is 5 µm and the relative resistance has increased 20%, therefore, the film is considered „failed“