

# Surface Quality

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## SQ-1

- How is surface profile data obtained using the FECO interferometer? Your explanation should include diagrams with the appropriate quantities defined.
  - Can resolutions of less than 10 angstroms in height be obtained? What are the major resolution limitations?
  - Why do the reference and test surfaces need to be coated?
  - How does this interferometer compare to a Fizeau interferometer? Is it better or worse? Explain.
  - It is also possible to measure surface profiles by dragging a stylus over the surface. Does a stylus yield higher resolution? Consider both lateral and height resolutions.
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## SQ-2

I have a Nomarski interference microscope that uses a 20X objective lens. I do not know the material or the prism angle of the Wollaston prism. However, I do know that if I illuminate the Wollaston prism with a linearly polarized collimated HeNe laser beam and if after the prism I place a properly oriented analyzer I obtain fringes with a spacing of 5 mm. What shear do I have in the Nomarski microscope? How does the shear compare with the resolution of the microscope? (If you need to make any assumptions, state them.)

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## SQ-3

I have a Mirau interferometer attachment with a microscope. The light source used with the microscope is a tungsten source with a 40-nm wide bandpass filter centered at a wavelength of about 600 nm.

- I am using the Mirau to measure the surface roughness of some magnetic tape. It is hard to keep the tape flat, so I put a thin piece of glass on top of the tape to keep it flat. I find I have much difficulty getting good fringe contrast. Why? Approximately how thick can the glass (with a dispersion of  $4 \times 10^{-6} / \text{\AA}$ ) be before the fringe contrast is unacceptable? State any assumptions you make.
  - I am now using the Mirau interferometer to measure the radius of curvature of a spherical surface. If I am looking at a sample 0.5 mm in diameter, approximately how small can the radius of curvature be before I lose fringe contrast at the edge of the sample? How do I determine if the surface is concave or convex?
  - If I am using a 20X objective and a detector array with 50  $\mu\text{m}$  spacing to detect the fringes, would I be able to resolve the fringes at the edge of the mirror in part b)? With this detector array, what is the smallest radius of curvature I can measure? For this radius of curvature what width is needed for the bandpass filter to obtain high contrast fringes?
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## SQ-4

The Lyot test is used to measure a sample at normal incidence and a wavelength of 633 nm. The Lyot filter has no absorption. The sample is illuminated uniformly and there is no reflectance variation across the sample. The irradi-

ance of the image varies from 1 to 1.04. What is the maximum height variation across the sample?