



SUB-ANGSTROM ROUGHNESS MEASUREMENT FOR OPTICS

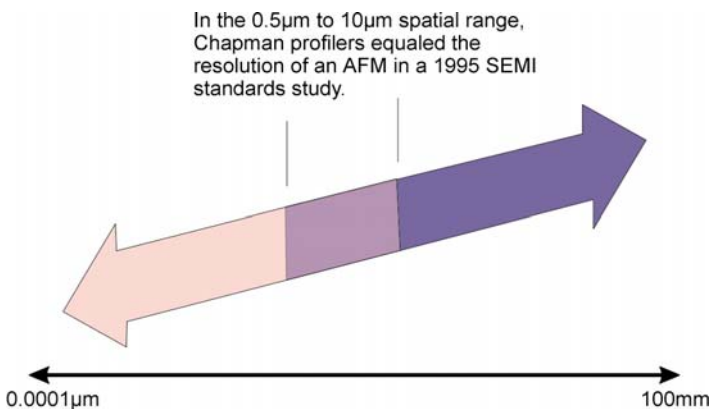
The measurement of the surface roughness is an important issue in the performance of optical lens or mirror. Roughness control of the optical surface becomes especially important for low roughness optics. In this application note, we examine sub-Angstrom roughness resolution measurements, made possible with the MP2100 Non-Contact Surface Profiler.

The MP2100 can measure most types of optics, small and large, flat and curved, including transparent, non-transparent and reflective surfaces. In the case of transparent optical lens surface, Chapman's unique focused laser can easily distinguish the top from the bottom surface with its fine auto-focus system.

The MP2100 can measure roughness in many configurations which can be useful during optical polishing and coating stages. It is during these crucial stages that the evaluation of the optical part takes place to improve the optical fabrication process. Figure 1 shows an example measurement of a smooth optical flat. The roughness average was measured over a 5 mm length with Rq (Rms) roughness average of 0.4 Angstrom.

The Chapman system produces high-quality surface measurements (height accuracy and spatial resolution) and to provide consistent measurement (repeatability).

Accuracy. A 1995 SEMI standards study demonstrated that Chapman Profilers equal the accuracy of an Atomic Force Microscope when measuring vertical features within the AFM's range.



High Resolution Inspection using MP2100 System

Example: Vertical Resolution Better than 1 Angstrom (Smooth Mirror)

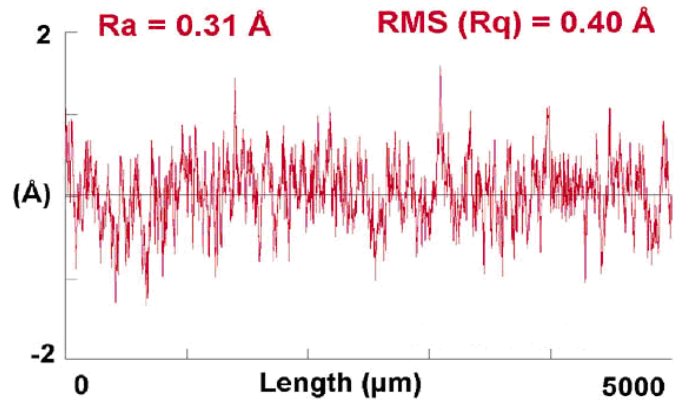
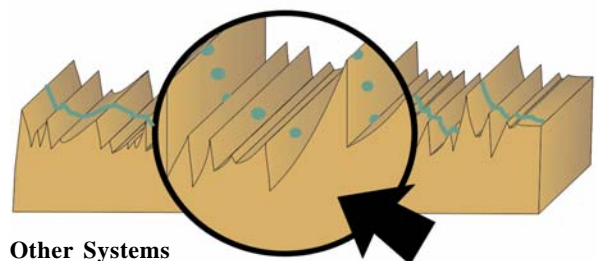
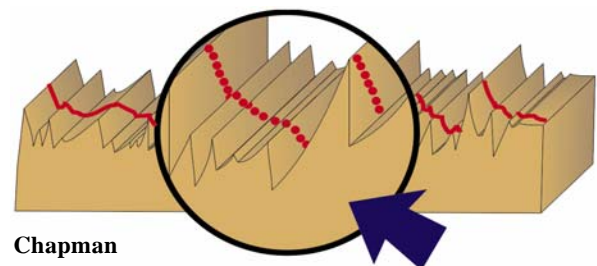


Figure 1: Measurement example of a Sub-Angstrom roughness optical flat

Resolution. With the ability to sample 2,000,000 data points in a single scan of up to 100mm, the MP2100 maintain ultra-high resolution irrespective of scan length. The large number of data points provides precise detail of large, medium and small features. With other surface profilers, as the scan length increases, the sampling interval decreases. Some small features are undetected.



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System Features

Applicable to measure most optics
Measurement at any location on surface - Linear and Circular
Integrated CCD Nomarski Viewing System
PC Pentium computer
Windows XP® based operational software
Complete 360° Circular Scan
Autofocus/Autotracking
Programmable sample positioning
Automated event logging and viewing
Password security
Vibration isolation table workstation

Performance Specifications

Vertical Resolution:	0.01 nm
Horizontal Resolution:	0.5 μm
Linear Scan Length:	Up to 100 mm
Circular Scan Length:	Complete circumference
X and Y Stage Resolution:	1 μm
Theta Stage Resolution:	0.001 Degree
Data Sampling	50 nm (minimum)

Options

Nomarski Viewing System Printer
Color Printer
NIST Roughness Standard

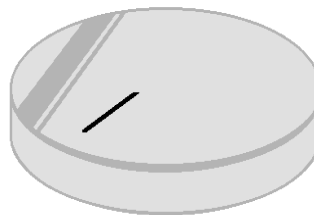
Software

Roughness Parameters:	Ra, Rq, Rp, Rv, Rpm, Rvm, Rt, Rz, Rsk, Rku, and more
Waviness Parameters:	Wa, Wq, Wp, Wv, Wt
Other Parameters:	Histogram, Cumulative Distribution, Power Spectrum, Slope, etc.
Programmable Cutoff Filter:	Conforms to SEMI, ANSI B46.1 and ISO standards

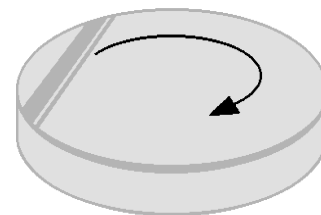
Optical Lens Measurements

- Complete 360 degree circular scans at any radius
- Over curved optic surfaces
- Surface and edge defect inspection
- A single keystroke to implement a customized measurement sequence
- Rapid circular scan at outer edge
- Surface roughness at any location, linear or circular measurement geometry

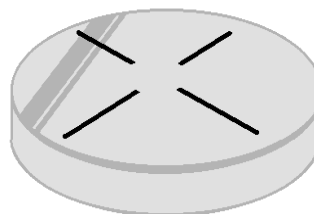
Lens Measurement Geometries



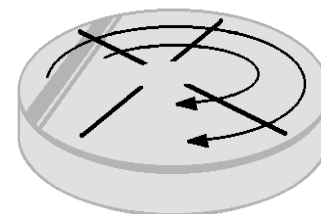
Linear Roughness Measurement up to 100 mm



Circumferential Measurement 0 - 360°



Roughness Uniformity Measurements



One Recipe Multiple Measurements

