

OPTICAL PROFILOMETER SYSTEM

The Naval Research Laboratory (NRL) has a requirement for a non-contacting, optical surface profilometer system. This system will be used to quantitatively characterize the surface topography of a wide range of materials made and studied in the laboratory. Experience has shown that while some surfaces are relatively flat, most are not. Moreover, height variations across the surface range from less than one micrometer to several centimeters. Surface area ranges from roughly 100 μm x 100 μm to 10 cm x 20 cm; linear scan lengths range from 0.1 mm to 100 mm. In addition, the materials often have "rough" surfaces, such as porous materials and gels, "chemically sensitive surfaces" (from dangerous to sticky), fiber brushes (e.g., electrical), cloth weaves, printed circuit boards with soft and hard layers, and biological films (like barnacle adhesives and slime layers). The system must consist of two different profiling instruments, in order for the system to profile over the lengths and areas mentioned above.

The profilometer system must meet or exceed the following minimum specifications:

1.0 General System Requirements

- a. The system must contain optics, consisting of a microscope, lenses, and a capture device as specifically described in paragraphs 5.0 and 6.0 below.
- b. The system must include two translation stages (X, Y) of at least 100 mm each (precision of 0.1 μm).
- c. The system must include a z-motorized stage.
- d. The system must include a tilt platform.
- e. The system must come with a pneumatic vibration isolation table or workstand.
- f. The optical system must include a computer-driven data acquisition system. This acquisition system shall have a PC-based motion controller and software that can be used to analyze the 2D and 3D data acquired. The data acquisition system must also be able to display the scan position and stitch together individual 2D or 3D data sets to produce profiles of areas larger than can be scanned by the lens during one pass. The hardware and software must meet or exceed the following minimum requirements:
 1. Hardware
 - a. The computer must have the capability of a Pentium 4 or equivalent,
 - b. The operating system must run Windows XP_SP2 or a later version
 - c. The computer must have a CD RW + DVD drive

2. Software requirements

- a. The computer must come loaded with analysis software, which must perform image processing (e.g., leveling, thresholding, and Plane Correction routines) needed to produce quantitative 2D and 3D profiles, and it must contain routines to calculate common roughness parameters and statistical distributions such as Abbott-Firestone curves, Fast Fourier Transforms, and autocorrelations. The software must be easily operated by personnel whose skill level ranges from a lab technician's to a PhD scientist or engineer.

2.0 Documentation and Warranty

The successful offeror shall provide documentation and warranty terms customarily provided to the public with a commercial item for all equipment provided.

3.0 Used Equipment

Offers of used equipment will not be accepted.

4.0 Installation and Training

The price of the profilometer must include installation at the Naval Research Laboratory, Washington, D.C. Training must also be provided at the Naval Research Laboratory for 3 people for 2 days.

5.0 Specifications for Optical Profilometer based on Interferometric Technique (CLIN 0001)

NRL has a requirement for an optical profilometer based on the interferometric technique. This profilometer must be capable of doing vertical scanning interferometry and phase shift interferometry. The optical profilometer based on the interferometric technique must meet or exceed the following minimum specifications:

- a. The microscope must have a trinocular head with at least a 10x eyepiece;
- b. The profilometer must have a 50 Watt or greater quartz halogen light source with variable power supply;
- c. The profilometer must have auto-focus,
- d. The profilometer must have a motorized interference filter and a motorized z-axis stage with a vertical range of at least 10 mm;
- e. The profilometer system must allow surfaces to be viewed with at least three objectives (2.5x, 10x Mirau and 50x Mirau) and a 4-Position Magnification Wheel.
- f. The profilometer must have a motorized x-y stage, which must be able to probe samples at least 10 cm in length.

- g. The profilometer system must come with control and analysis software, which must include stitching and transparent film thickness measurement.
- h. The profilometer must have a demonstrated vertical resolution of at least 1 Angstrom RMS in phase shifting mode and 10 Angstroms in the vertical scanning mode.
- i. The profilometer must be able to acquire profilometry data and confocal intensity maps.
- j. The profilometer must have two 17" flat panel displays.

6.0 Specifications for an Optical Profilometer based on Chromatic Aberration (CLIN 0002)

NRL has a requirement for an optical profilometer based on confocal microscopy and extended axial chromatism, also known as a chromatic aberration technique. This profilometer must meet or exceed the following minimum specifications:

- a. The hardware must include a 300-W Arc Xenon Light Source with an optical fiber adaptor; 1 opto-electronic cabinet and three optical fibers of length 2 meters; five optical pens (100 um, 300 um, 1 mm, 3 mm and 12 mm) and five magnifiers, with lateral resolution down to 1 micron;
- b. The profilometer must include a tilt platform
- c. The profilometer must have a motorized stage for the z-axis.
- d. The data acquisition speed must be up to 4000Hz.
- e. The controller software must be able to find and re-locate sample co-ordinates from previous images and must including stitching.
- f. The profilometer must have one 17" flat panel display.

7.0 Option Items

7.1 Option Items for CLIN 0001

Option items for this instrument include additional objectives for viewing surfaces and an additional software license. The objectives are as follows:

- a. A 10x visual objective (CLIN 0003)
- b. A 5x Michelson objective (CLIN 0004)
- c. A 20x Mirau objective (CLIN 0005)

Another option item for this instrument is for the successful offeror to provide an additional license to run the software provided. (CLIN 0006)

7.2 Option Items for CLIN 0002

- a. As an option item for this instrument, the successful offeror shall provide an additional license to run the software provided. (CLIN 0007).

