56 Sparta Avenue • Newton, New Jersey 07860
(973) 300-3000 Sales • (973) 300-3600 Fax
www.thorlabs.com

SSM1010B - December 28, 2017

Item # SSM1010B was discontinued on December 28, 2017. For informational purposes, this is a copy of the website content at that time and is valid only for the stated product.

SUPER POLISHED MIRROR BLANKS

- **Ø1/2" and Ø1" Super Polished Mirror Blanks**
- **Surface Roughness Options: <1 Å or <2 Å**
- **Ideal for Ultrafast Applications**
- **Custom Coatings Available**

SSM1020A

SSM0510A

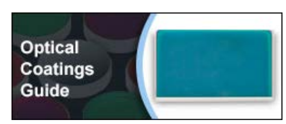
SSM1010B

SSM0520B

Hide Overview

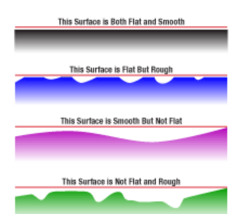
OVERVIEW

Features



- Ideal for Ultrafast Applications
- Surface Flatness: λ/10 or λ/20
- Surface Quality: 10-5 Scratch-Dig
- Surface Roughness: <1 Å or <2 Å
- Mirror Thickness: 6 mm (0.24")

Thorlabs' Super Polished ultra-flat mirror blanks are designed to be used as front surface mirrors when coated. Fabricated from UV fused silica, these mirror blanks offer superior surface flatness and roughness, as well as exceptional environmental durability. Surface flatness is a global measure of an optic's flatness across the entire face, measured in fractions of a wavelength. Roughness, on the other hand, describes the local texture of the surface and is measured in RMS Å (see image to the right). The super polished blanks offered here provide surpassingly low surface roughness down to <1 Å (see *Specs Tab* for more information). The superlative surface roughness makes these blanks ideal for femtosecond applications.



Click to Enlarge

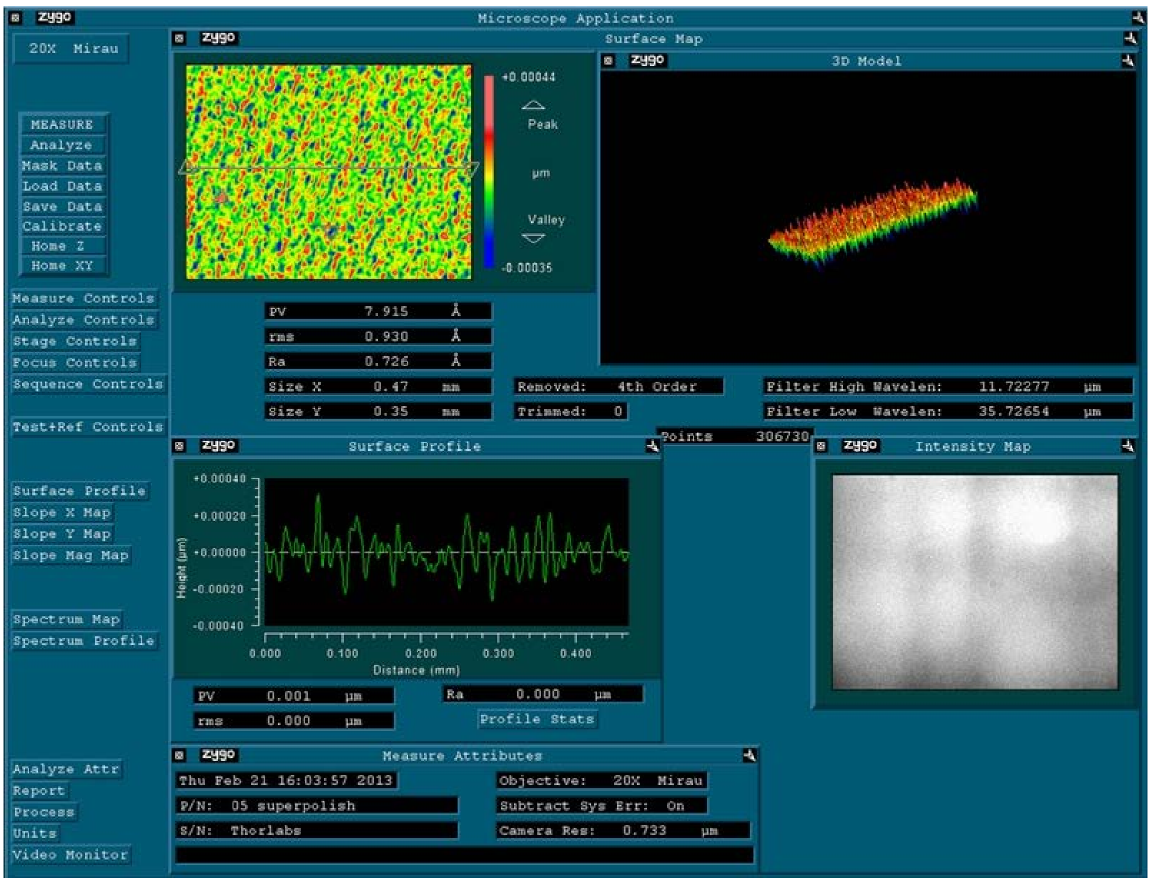
These super polished blanks can be coated with our reflective coatings such as broadband dielectric, metallic, or custom coatings. These coatings can provide high reflectivity for ultraviolet through near-infrared wavelengths. Please contact Technical Support for information on coatings and price. For applications that do not require such high tolerances on flatness and roughness, Thorlabs also offers a line of economy mirror blanks.

Hide Specs

SPECS

Mirror Blank	SSM0510A	SSM0520A	SSM0510B	SSM0520B	SSM1010A	SSM1020A	SSM1010B	SSM1020B
Diameter	1/2" (12.7 mm)				1" (25.4 mm)			
Diameter Tolerance	+0.0 / -0.1 mm							
Thickness	6.0 mm							
Thickness Tolerance	±0.2 mm							
RMS Roughness[a]	<1 Å	<2 Å	<1 Å	<2 Å	<1 Å	<2 Å	<1 Å	<2 Å
Surface Flatness[b]	λ/10		λ/20		λ/10		λ/20	
Surface Quality	10-5 Scratch-Dig							
Clear Aperture	>90% of Diameter							
Parallelism	<3 arcmin							
Back Surface	Fine Ground							

- Within detection resolution
- At 632.8 nm over clear aperture



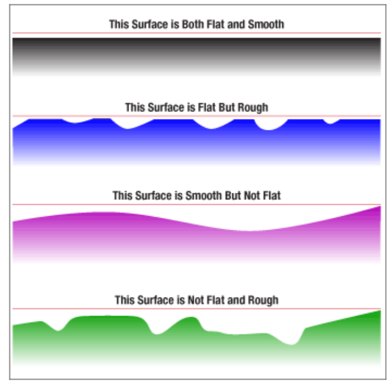
Interferogram displayed in Zygo of our super polished mirror blank, taken with a 632.8 nm laser, measures the surface height as a function of optic position. In this inteferogram an area 0.47 mm by 0.35 mm of the super poslished mirror blank was examined. The measurement determines the RMS surface roughness (0.930 Å for this example) and displays the surface profile as an intensity map.

Hide Roughness Tutorial

ROUGHNESS TUTORIAL

Surface Texture

In optics, surface texture describes how well an optic will perform in the laboratory. The perfect mirror, for example, would have no surface texture; it would be perfectly smooth and flat (much like the top image in the cartoon to the right). Light that is incident on such a surface will be reflected and



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refracted uniformly since the geometry of the surface remains constant. In contrast, light incident on a highly textured surface (i.e., a surface with a defined roughness), will be reflected and refracted heterogeneously since the surface geometry is not the same at every point across the surface. The rougher the surface, the greater this variation will be, which in turn, will cause a greater amount of scattering from the optic's surface.

In general, surface texture is defined by three different properties: flatness, waviness, and roughness (as will be shown later, each property represents a portion of the spatial frequency domain). Surface flatness is measured in waves (e.g., λ/10) and is characterized by low spatial frequencies. Flatness is used to indicate the quality of the optical polishing of the optic. This metric details an optic's ability to preserve the properties of an incident wavefront; flatter optics impart less distortion to the wavefront.

Surface waviness, which is measured in angstroms, is characterized by mid spatial frequencies. Since waviness is more commonly used to describe matte surfaces and not optical-quality surfaces, it will not be considered in this discussion. Finally, surface roughness, also measured in angstroms, is characterized by high spatial frequencies. Roughness is used to describe the variations of the residual surface height (explained below) over short spatial wavelengths. An optic may be considered to be optically smooth when the height variation of the surface texture is considerably smaller than the wavelength of the light it is designed for.

The surface texture of any optic is typically calculated from the difference in the measured optic's surface and a standard 2D polynomial fit. This difference is referred to as a residual surface; by applying a spatial filter to the residual surface, the optic's surface roughness can be calculated. The spatial filtering of the residual surface yields different properties related to surface texture. Fourier analysis allows for these properties to be represented as a summation of sine waves, and thus can be sorted according to their spatial frequency components. By separating these frequency components into low, mid, and high spatial frequencies, the various properties of surface texture can be calculated (i.e., surface flatness, surface waviness, and surface roughness, respectively).

Calculating Surface Roughness

As described above, Fourier analysis allows us to break down the residual surface into different spatial frequency domains. Once the high spatial frequencies have been isolated, the surface roughness of an optic can be calculated. In general there are three different metrics through which surface roughness can be represented.

The arithmetic average, R_a, is simply the average deviation of the residual surface compared to the best fit surface.

$$R_a = \frac{1}{N}\sum_{i=1}^{N}|y_i|$$

In the equation for the arithmetic average, y_i is the height difference from optimal of each point and N is the number of discrete measurements.

The root mean squared (RMS), R_q, gives a statistical measure of the RMS deviation of the residual surface compared to the best fit surface.

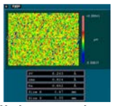
$$R_q = \sqrt{\frac{1}{N}\sum_{i=1}^{N} y_i^2}$$

Again, y_i is the height difference from optimal of each point and N is the number of discrete measurements. While the arithmetic average yields only information on the mean value of the deviation, the RMS produces information about the mean and statistical error. There are two notable results from this. The first is that the RMS value innately contains information about the standard deviation in the measurement. The second is that the RMS value will always be greater than the arithmetic average. Thorlabs utilizes the RMS value for our surface roughness specs.

The final metric is the simplest, the peak-to-valley value, PV. The PV metric is merely a measure of the distance between the highest and lowest points measured. As such, it yields no information on mean values nor statistical variation.

Measuring Surface Roughness

Thorlabs uses Zygo's NewView white light interferometer to measure surface roughness. We use this tool to capture a 3D interferogram of an optical surface and by applying statistical methods we can determine the surface roughness. Below are two sample interferograms for a measured optic. On the left is a surface roughness measurement, on the right is a flatness measurment. For flatness specs, Thorlabs uses the PV value.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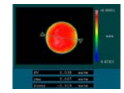
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Hide Ø1/2", λ/10 Mirror Blanks

Ø1/2", λ/10 Mirror Blanks

Part Number	Description	Price	Availability
SSM0510A	Ø1/2", UV Fused Silica Super Polished Mirror Blank, <1 Å Roughness, λ/10	$230.00	Today
SSM0520A	Ø1/2", UV Fused Silica Super Polished Mirror Blank, <2 Å Roughness, λ/10	$204.00	Today

Hide Ø1/2", λ/20 Mirror Blanks

Ø1/2", λ/20 Mirror Blanks

Part Number	Description	Price	Availability
SSM0510B	Ø1/2", UV Fused Silica Super Polished Mirror Blank, <1 Å Roughness, λ/20	$255.00	Today
SSM0520B	Ø1/2", UV Fused Silica Super Polished Mirror Blank, <2 Å Roughness, λ/20	$230.00	Today

Hide Ø1", λ/10 Mirror Blanks

Ø1", λ/10 Mirror Blanks

Part Number	Description	Price	Availability
SSM1010A	Ø1", UV Fused Silica Super Polished Mirror Blank, <1 Å Roughness, λ/10	$255.00	Today
SSM1020A	Ø1", UV Fused Silica Super Polished Mirror Blank, <2 Å Roughness, λ/10	$230.00	Today

Hide Ø1", λ/20 Mirror Blanks

Ø1", λ/20 Mirror Blanks

Part Number	Description	Price	Availability
SSM1010B	Ø1", UV Fused Silica Super Polished Mirror Blank, <1 Å Roughness, λ/20	$281.00	Lead Time
SSM1020B	Ø1", UV Fused Silica Super Polished Mirror Blank, <2 Å Roughness, λ/20	$255.00	Today