LCGT Beam Splitter (BS)

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			DCN NO.	REV	DATE
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Applicable Documents

LCGT-MIR-D00003-V1 Fused Silica Substrate, LCGT Beam Splitter
LCGT-XXXXX-A Fused Silica Blank, LCGT Beam Splitter
LCGT-XXXXX-A Fused Silica Blank, LCGT Beam Splitter

Requirements

Physical Configuration

According to LCGT-MIR-D00003-V1 Fused Silica Substrate, LCGT Beam Splitter

Fabricate from

LCGT-XXXXX-A Fused Silica Blank, LCGT Beam Splitter
LCGT-XXXXX-A Fused Silica Blank, LCGT Beam Splitter

Registration Marks

Registration marks shall be etched, ground or sandblasted and located per LCGT-MIR-D00003-V1

Surfaces, Side and Bevel Polish

All Surfaces, Sides and Bevels shall be polished using a progression of smaller grit sizes. The last step before final polish shall be equal to or less than a five micrometer grit finish. These surfaces shall appear transparent with no grey, scuffs or scratches visible to the naked eye when viewed in normal room light against a black background.

Bevel

Bevel for safety per LCGT-MIR-D00001-V1

Serial Number

Serial Number "BS XX" shall be shall be etched, ground or sandblasted on the barrel of the optic per LCGT-MIR-D00001-V1, where X is incremental starting with 01.

Scratches, Sleeks and Point defects

Point defects of radius greater than 25 micrometers are treated like scratches for the purpose of this specification.

Scratches and Sleeks, Surfaces 1 and 2

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The total area of scratches and sleeks on the entire surface shall not exceed 500 X 10^3 square micrometers (width times length.)

Point Defects, Surfaces 1 and 2

There shall be no more than 50 point defects of radius greater than 2 μm on the entire surface on each surface. Average density of defects less than 2 μm radius must be less than or equal to 5 per $4mm^2$

Scratch and Point Defect Inspection Method

1. The surface is examined visually by two observers independently. The examination is done against a dark background using a fiber optic illumination system of at least 200 W total power. A 100% inspection of the surface is carried out. Pits and scratches down to 2 micrometers in width can be detected using this method of inspection. Any scratches or sleeks that are detected will be measured using a calibrated eyepiece.

2. Further inspection will be done with a minimum 6X eyeglass using the same illumination conditions, again with two observers. Sleeks down to 0.5 micrometers wide can be detected using this method. The surface will be scanned along one or two chords from centre to edge, then at ten positions around the edge, and ten to fifteen positions near the centre.

3. An inspection is then carried out with a dark or bright field microscope, with 5x objective at four positions at each of the following locations:

a. Within 10mm of the center of the surface.

b. Equally spaced along the circumference of a centered, 60 mm diameter circle.

c. Equally spaced along the circumference of a centered, 120 mm diameter circle

Surface Figure, measured over the central 225mm diameter

Surface 1: Nominally Flat. Radius of curvature: Flat > 300 Km concave, >1000 Km convex
Astigmatism: < 8 nm Amplitude of the Zernike coefficient $Z_{2,2}$ as defined in Born and Wolf pp. 523-525.

Surface 2: Nominally flat. Surface two should be polished such that the Radius of curvature of Surface 1 as measured through Surface 2 and the material is > | 300 Km|

Surface Error, Low Spatial Frequency: measurement aperture to 1 mm^{-1}

The following root mean square standard deviation (σ_{rms}) values are calculated from the phase maps which are to be provided with each optic. For this calculation the amplitudes for the best fit Zernike terms $Z_{0,0}$, $Z_{1,1}$, $Z_{2,0}$ and $Z_{2,2}$ or corresponding Seidel aberrations are subtracted from the phase map. Known bad pixels may be excluded from this calculation.

Surface 1, Frequency Band: < 1 mm^{-1}
Measured outside the central 340 mm diameter aperture: σ_{rms} < 3 nanometers
Measured over the central 200 mm diameter aperture: σ_{rms} < 2 nanometers

Surface 2 - Frequency Band: < 1 mm^{-1}
Measured outside the central 340 mm diameter aperture: σ_{rms} < 4 nanometers
Measured over the central 200 mm diameter aperture: σ_{rms} < 2 nanometers

Error, High Spatial Frequency: $1 - 750\ mm^{-1}$

Surface 1 HSF error $\sigma_{rms} \leq 0.3$ nanometers measured at the following locations:

1. Within 2mm of the center of the surface.
2. Four positions equally spaced along the circumference of a centered, 60 mm diameter circle.
3. Three positions equally spaced along the circumference of a centered, 120 mm diameter circle.

Surface 2 HSF error $\sigma_{rms} \leq 0.5$ nanometer measured at the following location:

1. Within 2mm of the center of the surface.

Inspection

Table 1: Inspections

Specification	Test Method and frequency	Data Delivered
Dimensions	Measurement 100%	Measurement Results
Scratches and Point defects methods 1 and 2	Visual Inspection 100%	Hand sketch including scratch/pit dimensions
Scratches and Point defects method 3	Visual Inspection 100%	Digital image of each inspection location
Figure	Interferometry 100%	Surface phase maps
Errors - Low Spatial Frequency	Interferometry 100%	Surface phase maps
Errors - High Spatial Frequency	Interferometry 100%	Surface maps for 3 central locations. Numerical values included with certification

Orientation: For the purpose of full surface phase maps the data shall be oriented such that the substrate registration mark is at the top center of the data.

Format: All Data shall be delivered according to Table 1. In addition to the hard copy, an electronic data set of the phase maps shall be delivered in ASCII.