



aLIGO TGG crystals for the Input Optics Faraday isolators

AUTHOR:	CHECKED:	DATE	APPROVALS		
			DCN NO.	REV	DATE
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Blank Material – CFM (For Information Purpose Only)

Material	Terbium Gallium Garnet (Tb ₃ Ga ₅ O ₁₂), provided by Northrop Grumman	
Orientation	[111] within 5 degrees	
Physical Dimensions	Rod, 20 mm +0.00 mm/-0.05 mm diameter and 12 mm +0.5 mm/-0.0 mm thick	
Wavefront Distortion (@ 632 nm) - for large rods with diameter > 3 mm or length > 25.4 mm	< 1/8 wave per inch of rod length	
Refractive Index @ 1064 nm	1.954	
Verdet Constant, V @ 1064 nm	-40 RadT ⁻¹ m ⁻¹ or higher absolute value	
Absorption Coefficient	< 0.0015 cm ⁻¹	
Final Shaping	Flatness	lambda/10 wave at 633 nm wavelength
	Parallelism	< 1 minutes of arc
	Perpendicularity	< 10 minutes of arc
	Surface Quality	10 - 5 scratch-dig per MIL-0-13830A

Polishing Requirements:

Physical Dimensions of super-polished material	
Diameter	20 mm +0.00 mm/-0.05 mm
Thickness	6 pcs: 10 mm +/-0.25 mm 4 pcs: 11 mm +/-0.25 mm
Clear Aperture	16 mm
Surfaces 1 and 2 – Superpolishing requirements	
Bevel	Bevel for safety 0.005”+/-0.003” on both sides at 45 deg
Flatness	lambda/10 wave at 633 nm, over the clear aperture.
Parallelism	< 1 minutes of arc
Perpendicularity	< 10 minutes of arc
Surface Quality	No scratches, sleeks and surface defects of radius greater than 2 micrometers within the central 16 mm diameter. 10 - 5 scratch-dig per MIL-0-13830A outside the central 16 mm diameter.
Microroughness	<0.2 nm, over spatial frequency range 1/mm to 750/mm <0.5 nm, over spatial frequency range 0.1/mm to 1/1mm
Barrel Polishing – No process necessary	



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Coating Requirements:

Surfaces 1 and 2 – Antireflective at 1064 nm	
Coating Area	1 mm to bevel
Coating Deposition Method	Ion Beam Sputtering
Angle of Incidence	0 deg (normal incidence)
Reflectance	<300 ppm
High Average Optical Power	>300 kW/cm ² sustained
Coating Temperature Stability	The specified optical performance must be maintained over a temperature range from 20°C to 30°C
Absorption	<15 ppm
Surface Quality of Coated Optic	The coating process should preserve the surface quality of the substrate specified above.
Figure Change Before/After Coating	Coating uniformity and stress from the coating process shall not change the flatness more than 30 nm p-v over the clear aperture. Also, coating process should not add surface figure Zernike terms higher than the second order with amplitude larger than 0.5 nm over the central 10 mm.
Bevel Coating – No process necessary	

Measurement Matrix - Frequency and Method

Specification	Test Method	Frequency of Inspection	Data Delivered
Physical Dimensions	Measurement	100%	Diameter, Thickness
Surface Quality	Visual Inspection	100%	Hand Sketches including defect dimensions and digital images at the center of the surface (within 2 mm).
Microroughness	Interferometry	100%	Surface maps for 3 central locations on each side. Numerical values included with certification. One PSD data set from each surface should be included as text file with the electronic copies of the phase maps.
Spectral Scans	Measurement	100%	Spectrometer graphs of the Reflectance taken at relevant Angle of Incidence (as small as possible) over 500-1400 nm spectral range from each coating run. All spectrometer data to be provided in Excel spreadsheet format, with columnar data in increments of approximately 1 nm.
Reflectance @ 1064 nm	Measurement	100%	Reflectance value from each coating run.

All data shall be delivered according to this table. In addition to the hard copy, an electronic set of the phase maps shall be delivered in ASCII, VISON OPD or .DAT format. Include a data description: aperture size, pixel size, height units. Phase difference data shall be in units of nanometers. Surface maps and other materials received with the blank materials shall be preserved unaltered and returned with the polished/coated part at the end of the process.