AdV INJ: Polishing and coating specification for Input Mode Cleaner End mirror of Advanced Virgo

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Date: 15 May 2013
Version: 7

General parameters

Mirror Substrates			
Material	Herasil 102		
Outside diameter (mm)	145 ± 0.1		
Thickness (mm)	90 +4/-0		
Bevel	0.5 to 1 mm x 45°		
Wedge (mrad)	1 ± 0.2 on side A		
Flat (mm)	20 ± 1 on side C		
Polishing			
	Side A (AR surface)	**Side B** (HR surface)	**Side C** (side)
Curvature	Residual ROC>1km	See section: *Radius of curvature*	
Surface error (RMS)	< 20 nm on 50mm diameter	< 0.57nm See section: *Surface error*	polished
Surface defects	<= 10 scratches on 145mm diameter <= 5 digs on 145mm diameter		
Roughness (RMS)	< 10 Å on 50mm diameter	< 3 Å $(10^4\text{-}10^6\,\text{m}^{-1})$ See section: *Surface error*	
Coating			
Wavelength (nm)	1064 + 680	1064	
Coating type	AR @ 0° at 1064nm on 95mm Diameter R @ 15° at 680nm on 95mm diameter	HR @ 0° on 140mm diameter	none
Polarization	S	S	NA
Reflection	> 0.7 at 680nm < 1000ppm at 1064nm		NA
Transmission		< 1ppm	
Absorption	< 10ppm	< 1ppm	
Scattering	< 5 ppm	See section: *Surface error*	

An etched mark on Side C is required in order to give reference orientation for metrology
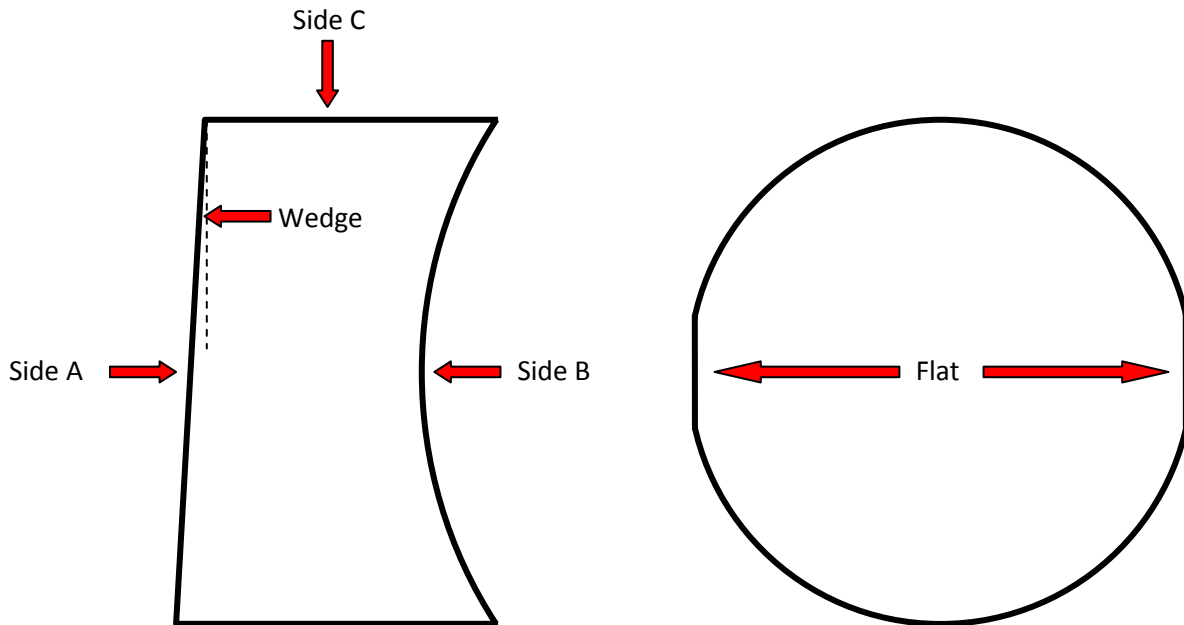
Radius of curvature

First requirement
Radius of curvature weighted by a Gaussian function:

$$I = e^{-\frac{2r^2}{\omega^2}}$$

Where r is the distance from the mirror center and $\omega = 10.8mm$.
N.B. For initial assessment of specification, the RoC can be estimated by a simple fit over an aperture diameter of 33mm instead of the Gaussian weighting.
Radius of curvature in ordinary and extraordinary axis → 185m +0m -1m

Second requirement
Radius of curvature in ordinary and extraordinary axis using a quadratic fit over all aperture diameters from 33mm to 140mm → 185m +0m -1m

Surface error
The surface error is specified using the power spectral density plotted in figure 1
This is a "2D PSD" i.e. the integration of the whole curve gives the square rms of the surface.

Power spectral density weighted by a Gaussian function:

$$I = e^{-\frac{2r^2}{\omega^2}}$$

Where r is the distance from the mirror center and $\omega = 10.8mm$.
N.B. For initial assessment of specification, the RoC can be estimated by a simple fit over an aperture diameter of 33mm instead of the Gaussian weighting.

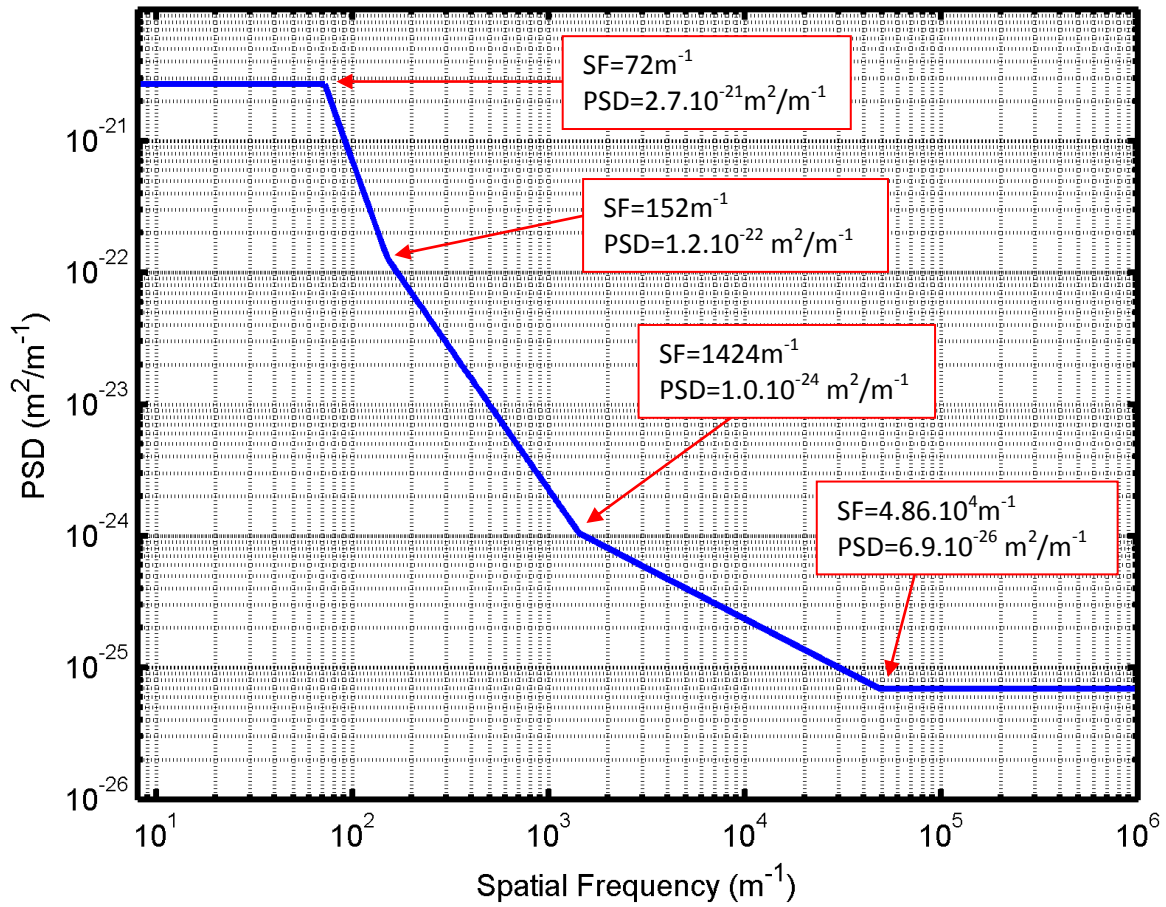The total rms of the given PSD is 0.57nm

Figure 1. Power Spectral Density specification for side B of the substrate.