WAVELENGTH OPTO-ELECTRONIC

Precision Manufacturing of Super-polished Optics
— *To enable high power laser application*

Introduction

One of the technology engines in high value-add photonics service is in the area of high power lasers and applications, ranging from scientific to precision material processing. High power laser optics and precision optics applications require stringent optics quality. Such manufacturing processes put up new capabilities including materials development, polishing techniques, coating techniques as well as metrology technologies. This application note specifically describes our new capability on super-polishing.

Operation Principle

A super-polishing capability for optics can produce extremely smooth surfaces on windows, mirrors, and other flat optics of various sizes, thicknesses, and materials. Super-polished surfaces are referring to surfaces with roughness less than 1nm. The whole super-polishing processing included a multi-axis spindling polishing plus a magnetic abrasive polishing, as shown in Fig. 1. After fabrication, atomic force microscope (AFM) was used to measure the surface roughness over an area of interest, as shown in Fig. 2. The measured roughness average value is less than 5 Å.

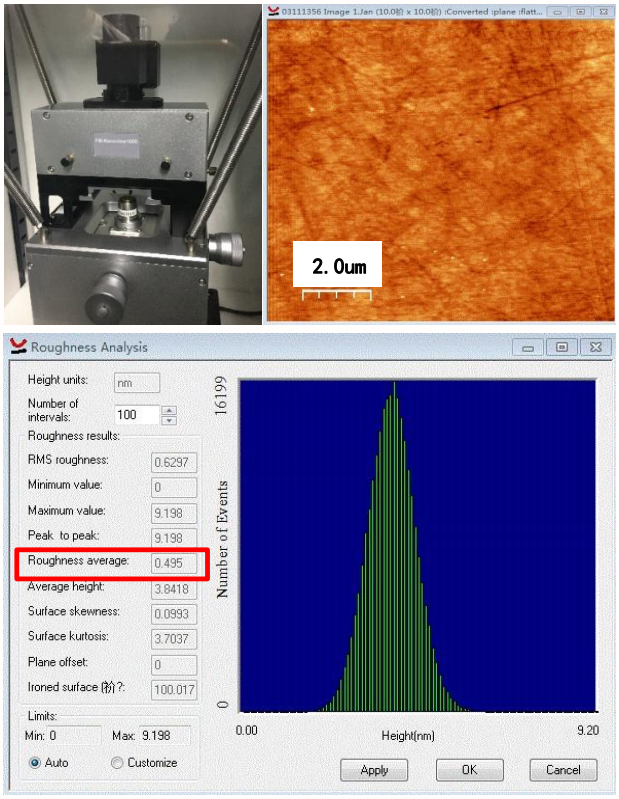

Figure 2. Atomic force microscope and surface roughness measurement.

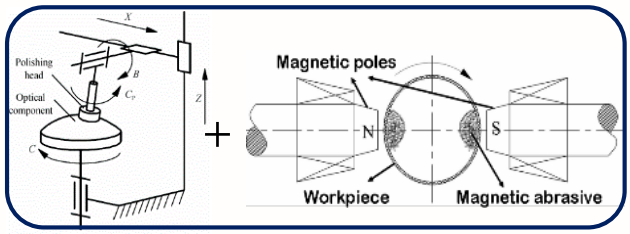

Figure 1. Two-step process of super-polishing technique

The above mentioned super-polishing process are applicable to various types of optical materials. Some commonly used materials and their properties are listed in Table 1.

Material	Index (588nm)	Transmission (um)	Optical uniformity	Stress uniformity (nm/cm)
H-K9L	1.5164	0.33- 2.1	2x10e-6	2
JGS1	1.4586	0.185- 2.5	8x10e-6	2-4
Heraeus 313	1.4586	0.185- 2.5	<10e-5	≤5
Corning 7980	1.4586	0.185- 2.5	-	≤5

Table 1. List of some typical optical glass materials for super-polishing.

Applications of super-polished optics

With the new capabilities in super-polished optics, the power handling of mirrors/lens/windows has been dramatically increased. This extend new market, especially in the area of:

- cavity-enhanced absorption spectroscopy (CEAS)
- ring laser gyroscope (RLG)
- Green HeNe laser for confocal microscopy and flow cytometry

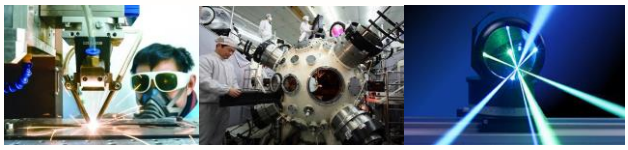

Figure 3. Application of high quality optics. Courtesy of photos: Raycus, SIOM and Temasek Research Lab

Conclusion

As a global enterprise, leading photonics innovation since 2002, WOE has continuous investment in the area of laser optics. The efforts include R&D on new process development, new material development, ISO compliant metrology practices in QA/QC.

Phone: (65) 6564 9624
Email: info@wavelength-tech.com
Website: www.wavelength-oe.com
Address: BLK 2 Bukit Batok ST 24, #06-09
Skytech Building Singapore 659480