Approved
Minutes
ASC OP1 ASC OP/SC 1, BSR/OEOSC-OP1.002, Optics and Electro-Optical Instruments – Optical Elements and Assemblies — Appearance Imperfections Task Force Draft Standard Review
Sunday, August 1, 2004, 9:00 a.m. — 4:00 .pm
Marriott Hotel City Center, Matchless Room
1701 California Street Denver, CO 80202

Attending	Committee Members (7/12)	Representing
☒	David Aikens	Zygo Corporation
☒	Gordon Boultbee	JDS Uniphase Corp.
☐	Walter Czajkowski	Edmund Industrial Optics
☒	Frank Dombrowski	Gage-Line Technology, Inc.
☐	Lincoln Endelman	SPIE
☒	John M. Hamilton	Northrop Grumman Corporation
☐	Jonathan Hardis	NIST
☐	Hal Johnson	Harold Johnson Optical Lab
☐	Yajun Li	Symbol Technologies, Inc.
☐	Joseph Oberheuser	OSA (ITT, Defense A/D Division)
☐	Kathleen Richardson	School of Materials
☒	William Royall	Eastman Kodak Company
	Observers	
☒	Charles Gaugh	Davidson Optronics, Inc.
☒	Gene Kohlenberg	OEOSC

Auditor's Summary of Meeting

At this meeting, the committee observed the viewing box produced by Davidson Optronics Inc. It also discussed interim results from a gage study that is being conducted at Northrop-Grumman. The committee concluded that it could not yet intelligently write a scope for the proposed scratch and dig performance standard, and decided to concentrate upon the selection of pertinent scratch and dig artifacts that produce reliable identification of imperfections on production optical components. Several companies will undertake the task of duplicating the gage tests conducted at Northrop-Grumman.

Welcome and Introductions

J. Hamilton opened the meeting at 9:05 a.m. Since there were two new participants each person was asked to introduce himself.

Adoption of Agenda

W. Royall moved that the draft agenda be adopted. C. Gaugh seconded the motion. The motion carried unanimously.

Approval of the Sunday, January 25, 2004, ASC OP/SC 1, BSR/OEOSC-OP1.002, Optics and Electro-Optical Instruments – Optical Elements and Assemblies — Appearance Imperfections Draft Review Minutes

The minutes had been distributed by e-mail. G. Boultbee moved that the draft minutes be approved. W. Royall seconded the motion, which carried unanimously.

Report of Gage Study

J. Hamilton presented an update concerning the gage study that is being conducted at Northrop-Grumman. The goal of the gage study is to standardize the scratch and dig inspection process. Northrop-Grumman originally began with the evaluation of inspectors' ability to reliably rank one set of US Army reference standard artifacts as compared with another. The current Northrop-Grumman procedure calls for visual ratings to be determined by comparing a sample optical element with the Kodak scratch and dig paddle. Three engineers then arrive at a consensus concerning the final ratings of the product. The study includes evaluation of the illumination level in addition to the comparison reference objects. Inspectors are being tested using the army standard, the Kodak paddle and an uncased reference standard. This study is important because several suppliers have visited Northrop-Grumman to negotiate the scratch and dig quality ratings for five to ten thousand optical components.

The difficulty in arriving at consistent visual ratings was discussed in a paper by Matt Young who worked at NIST. As a result of the Young study, NIST switched from v-groove references to square-bottomed references.

The Northrop-Grumman summary results are as follows:

- Of the three illumination levels used for the evaluation, level 1 gives more consistent results. The army reference standard was properly identified 50% of the time.
- There is only a 10% correlation among several inspectors.
- The army reference produced by Brysen resulted in proper identification of an artifact 20-30% of the time.
- Inspector results were demonsratably better with the Kodak reference paddle. Repeatability should be at least 70%. Repeatability was 71% with Northrop-Grumman inspectors who had good acuity. The range over several inspectors was 40-70%. Northrop-Grumman must finish reviewing the data, revisit the Matt Young paper, complete a draft report, and send the draft to Kodak for review.

C. Gaugh asked if MIL-O-3830 is obsolete. W. Royall explained that it has been reactivated as MIL-PRF-13830 with several appendices added. He also stated that the Kodak paddle was made in the 1980s to match the "gold standard" maintained at the arsenal. C. Gaugh noted that most of his customers order reference standards made to the Rev. H standard. About 20% ask for Rev. L. No physical measurements are supplied with the artifacts.

For the benefit of those persons who were newcomers to the ASC OP 1 meetings, an open discussion began concerning the global state of scratch and dig evaluation. Visual inspectors cannot produce reliable results when comparing samples with Rev. R artifacts. Military references prior to Rev. R give ambiguous results. The Kodak paddle produced more meaningful results, but the results were still not satisfactory.

The ISO 10110 drawing standard calls for two notations, visual and area. Appendix E lists the widths to which scratches are ranked. The ISO 14227 measurement standard describes artifacts that are made using chrome lines on glass. This standard is geared towards the use of a measurement machine.

The meeting was recessed for a coffee break.

Demonstration of an Objective Optical Imperfection Instrument by Davidson Optronics

C. Gaugh then demonstrated the Davidson scratch and dig test bench and showed samples of the scratch and dig references offered by Davidson and others:

- The current Rev. R standard
- Rev. A, H, and L standards
- A set of F428 standards by ASTM

ASTM has two surface imperfection standards (F428 and F548) for aircraft windows. The F428 references range from 0.3, "very light" to 0.8, "heavy" scratches. The 0.3 reference is about a MIL #40. Those present concluded that the device is versatile and acceptable. J. Hamilton observed that it might benefit with the addition of a controllable light source. W. Royall suggested that the Rudy Hartmann method might work if an adjustable illuminator were available to dial in a particular light level corresponding to the inspector's visual acuity and the given scratch width.

Results from Polling of Constituents for Functional Requirements of Optical Imperfections

While some of the committee participants had attempted to gather their requirements, there were no experts who could actually speak intelligently about how their functional requirements were impacted by scratch and dig imperfections on their optical components.

The John Greivencamp presentation at the previous meeting was reviewed, and the committee concluded that it is not able to discuss functional requirements, but should keep the issue as an open item on the "to do" list.

Plan an Objective Scratch Measurement Method

Notation

Notation was not addressed.

Measuring techniques and tools

F. Dombrowski offered to make a set of chrome-on-glass reference samples. D. Aikens noted that Annex E in ISO 10110-7 lists a series of existing chrome-on-glass samples. G. Boultbee reminded the group that the ISO standard gives a quantitative value for scratches of a given width L that can be used today by making comparisons under a microscope. W. Royall agreed that if the pertinent parameter is line width, then all of the tools exist to make comparisons. The problem is that line width may or may not adequately address the needs of inspectors for phase and intensity artifacts. J. Hamilton suggested that the committee needed to table the development of a scope for the performance standard and focus on designing artifacts that produce reliable comparisons. C. Gaugh offered to contribute reference artifacts from Rev. H and Rev. L. G. Kohlenberg would be asked to generate a $0 purchase order for the loaned artifacts.

Investigation of Other Technologies for Determining Equivalent Imperfections (e.g., Auto Industry), (ASME)

G. Boultbee stated that he would propose a study at JDS Uniphase to duplicate the Northrop-Grumman study. W. Royall said that he would propose the same at Kodak. D. Aikens said that at Zygo he would propose to study the Zeiss standard, the military standard

and the Kodak paddle. C. Gaugh offered to provide the committee data and information concerning F428 and F548 series of artifacts. D. Aikens will also investigate GIAT tools.

Scope of Imperfection Performance Standard
The development of the scope was tabled.

Status of BSR/OEOSC-OP1.002
This item was moved in the agenda because G. Kohlenberg's flight had been delayed by inclement weather. G. Kohlenberg reported that the BSR 8 form had been submitted to ANSI to start the final 60-day mandatory national review period. The review period ends on September 21. Per ANSI procedures, any interested party may contact OEOSC to purchase a copy of the draft standard and submit any questions or concerns about the draft standard to OEOSC. If no comments have been received by September 21, the final BSR 9 form to request permission to release the standard can be submitted to ANSI.

Photonics Spectra is waiting to write an article about the scratch and dig standard until after OP gets ANSI approval.

Time and Place

The committee decided to meet in San Diego, CA during Photonics West.

Adjournment
W. Royall moved that the meeting be adjourned. C. Gaugh seconded the motion. The meeting was adjourned at 3:15 p.m.