

Draft Meeting Minutes v2  
ASC OP TF 6 – IR Materials  
April 29, 2013, 10:00-11:30 AM  
Hilton Baltimore Hotel, Holiday Ballroom 1  
401 West Pratt St  
Baltimore, MD

## 1. Introductory Remarks

Gary Wiese of Lockheed Martin called the joint meeting to order at 10:02 with a brief introduction of all the attendees. He also made some opening remarks regarding his efforts to gain clarity on ITAR with respect to IR materials. He has attended two meetings so far, to discuss export control and USML, and while all feedback so far is hopeful, there is no official ruling yet. Many of these materials are made worldwide, so there it can be argued that they should not be on the USML or CCL.

P. Brown announced that Lattice requested a DDTC ruling four years ago on Si and Germanium in >3 inch diameter and was cleared for that shipment, but told that the material itself was considered USML items.

E. Stover applied for index data for similar materials and was approved with a ruling of EAR99, but future orders would be ruled on a case-by-case basis.

G. Wiese will continue to follow up with State and Commerce until we have clear guidance on how to proceed.

Dave Aikens of OEOSC made some opening remarks, and announced that ISO TC172 SC3 was not going to meet in Gaithersburg in September as they had originally planned. Therefore the work on ISO IR standards will be conducted by correspondence.

D. Aikens presented the draft agenda. N. Carlie moved we accept the agenda, and M. Quijada seconded. The motion carried. D. Aikens also presented the minutes, which P. Hallett moved we accept. A. Phenis seconded, and that motion carried as well.

## 2. NIST update

John Burnett of NIST gave a presentation on the minimum deviation system currently at NIST, and the plans for the near future. The presentation materials are available on the OEOSC TF6 meeting website, at <http://www.optstd.org/op1%202013meetings.htm>.

Current measurements are to 0.2 arcsec, which provides  $5 \times 10^{-7}$  capability at 20 +/- 5C. They plan to have the IR version up and running by the end of 2013, which will be capable of wavelengths from 1 to 14 um. They expect to be able to measure to  $1 \times 10^{-5}$ , and plan to establish n and dn/dt in their database which is public.

They are designing a version of the instrument that will go from 4K to 450K, but funding has not been approved. J. Burnett said that “if the need is there, it will get done.” G. Wiese said that if we get funding for a lot of prisms, NIST may not want to measure all the parts required. We may need to create transfer standards to allow other labs to calibrate their measurement systems. E. Stover mentioned that we will need a transfer standard for each type of material, since Czochralski process materials are different from Chalcogenides. In addition, attention should be paid to the range of deviation angles that need to be measured. E. Stover felt that 30 degrees was about right, but that Charms prefers 59 degrees for FS.

### **3. Sampling Protocols**

Adam Phenis of SAIC presented his current progress on sampling protocols. The presentation materials are available on the OEOSC TF6 meeting website, at <http://www.optstd.org/op1%202013meetings.htm>.

The sampling for the Czochralski process seems adequate. Some discussion occurred regarding the CVD plane growth structure, and how we would best sample the rectangular pipes; specifically, there was some concern that we needed samples from all four sides, but most people felt a sample from one side, but at multiple heights, would be better. N. Carlie said that the sampling for Chalcogenides would be the same as for the Czochralski process. P. Brown said the same was probably true for float zone Silicon.

A. Qiao pointed out that we may need prisms cut from two or even three directions to determine any anisotropy.

P. Brown said there was a lot of data already in the published domain, and we could reduce the number of samples required by tapping into some of the existing documentation.

A. Phenis agreed to take another cut at the sampling protocol based on this feedback. D. Aikens will send him the template for an American National Standard, and Adam will offer up a draft for the next meeting.

### **4. Review of ISO 17328**

Erik Stover of M3 presented his review of the CD for ISO 17328, which has been approved as a DIS. The presentation materials are available on the OEOSC TF6 meeting website, at <http://www.optstd.org/op1%202013meetings.htm>.

E. Stover told us that while great progress has been made on the standard, some issues remain, and we need to make some modifications to use it. He reviewed his comments line-by-line, and got generally positive feedback on his results. He will provide this feedback to the ISO project leader in the ISO comments template, during the upcoming DIS round of balloting.

J. Burnett pointed out that, in addition to E. Stover's comments, we may need to worry about shear as well, so slopes in the test prism may be important to monitor or specify. E. Stover will include some comments in this regard.

## **5. Survey results and fab tolerances**

Gary Wiese of Lockheed Martin presented a strawman set of tolerances for the test samples based on previous work, and reviewed the material survey sent out to the group after the last meeting. The presentation materials are available on the OEOSC TF6 meeting website, at <http://www.optstd.org/op1%202013meetings.htm>.

G. Wiese has proposed a set of tolerances to be used on our samples, based on a previous round robin campaign. Most notable was surface form, which G. Wiese studied in depth, and showed that we are sensitive to anything more than about 1/8<sup>th</sup> wave PV per surface if we want to have uncertainty below 10-5. Again, the problem of slope was discussed, and we concluded we will need some kind of slope spec as well.

Based on the survey, we have chosen seven optical properties for 15 materials that will be subject of this campaign. The seven properties to be studied are, in order of importance, refractive index, absorption coefficient, dn/dT, homogeneity, inclusion size and density, birefringence, and photoelastic constant. The materials of interest are Germanium, Zinc Selenide, Zinc Sulfide, Silicon, Calcium Fluoride, IRG 2, 3, 4, 5 and 6 glasses by Schott, Barium Fluoride, UVIR Glass, Magnesium Fluoride, Gallium Arsenide, and Magnesium Aluminate. The material list and properties list are subject to change based on funding availability.

It was pointed out that we should probably change from the Schott brand names for the Chalcogenide glasses to the chemical compositions.

## **6. Materials metrology**

Nathan Carlie of Schott was asked to present on his metrology instrumentation, especially for his work on homogeneity and bulk imperfections, but instead presented on the status of Chalcogenide development at Schott. The presentation materials are available on the OEOSC TF6 meeting website, at <http://www.optstd.org/op1%202013meetings.htm>.

N. Carlie's presentation is too long and technical to review in detail in the minutes, and the reader is encouraged to review the presentation online. The key messages however were that a) Schott continues to develop new IR optical glasses, and will continue to do so in the future, b) care needs to be taken in the development of new Abbe numbers for these glasses over the spectra of interest by application, and c) extrapolation of index data is extremely unwise. Specifically, you need to fit with six

very specific wavelengths, or you need a lot of points spread out over the entire spectrum of interest, to get an accurate assessment of the dispersion.

In a quick summary at the end, N. Carlie said that the current inspection capability for Striae and Imperfections can get down to 40 um spatial resolution. G. Wiese said that the optical design community wants to get down to 10 um.

## **7. Prism coupler capabilities**

Amy Qiao of Pacific Northwest National Lab presented on the PNNL capabilities for measuring index using the prism coupler method. The presentation materials are available on the OEOSC TF6 meeting website, at <http://www.optstd.org/op1%202013meetings.htm>.

The summary of the presentation is that the prism coupler method is extremely fast and cheap, and will get us to 10<sup>-4</sup> or so in resolution at various specific wavelengths ranging from Vis to 11.5 um. It is also capable of measuring birefringence with a second measurement, and it can be used on standard plates, rather than prisms. This comes at the cost of low spatial resolution and the potential for contact damage.

It may be possible to combine the precise (but time consuming and expensive) approach of NIST to make the transfer standards, with the fast and less expensive prism coupler approach to get a large number of our measurements done cost-effectively.

## **8. Time and place for next meeting**

Given the size of the group, it will be very difficult to conduct a meeting by teleconference, so we will need to plan for another face-to-face meeting at the next conference. G. Wiese asked for a show of hands on whether Monday or Thursday was better, and most people felt Monday was better, especially in the afternoon, but it depended on what papers were being presented. G. Wiese will schedule the next general meeting, and it will be announced to the group by OEOSC and SPIE.

## **9. Adjourn.**

A. Phenis moved we adjourn. E. Stover seconded, and the motion carried. G. Wiese adjourned the meeting at 12:36.