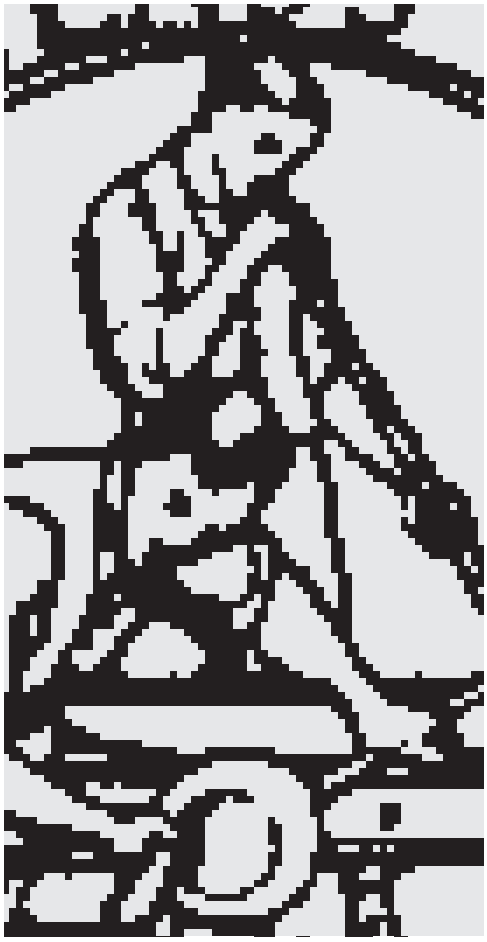

NO. 1 2005

SGT NEWS

Compiled and published by dmg world media (uk) ltd on behalf of the Society of Glass Technology

GLASS AND OPTICAL MATERIALS DIVISION FALL 2004 MEETING

Incorporating the XIV International Symposium on Non-Oxide Glasses (ISNOG)

The Glass and Optical Materials Division of the American Ceramics Society held its Fall meeting in conjunction with the14th International Symposium on Non-Oxide Glasses (ISNOG) in Florida on 7-12 November 2004. The conference brought together students and scientists from the cutting edge of oxide and non-oxide glass processing, properties and applications research. Matthew O'Donnell of the University of Nottingham was presenting his work on the processing and properties of TeO_2–Na_2O–ZnF_2 optical fibre; fluorinating the batch material and increasing the melting time to 10 hours gave a flat loss spectrum of around 5 dB/m and below in the 700 nm to 2·5 μm region. He provides his account of the meeting.

Due to the hurricanes which hit Florida, the combined GOMD / ISNOG conference had to move venue at the last minute, from Cocoa Beach to Cape Canaveral. However, conference chairs Dr Kathleen Richardson of the University of Central Florida and chair of the SGT North American Section, and Dr John Ballato of Clemson University, South Carolina, put together an outstanding programme, venue and set of events (with perfect weather too!). The ISNOG part of the conference contributed more to the novel glass side, especially chalcogenides, and the GOMD more to conventional glass systems/technology, such as silicates and phosphates. This created an evenly balanced technical programme on optical glasses and glass science and technology, covering all bases from structure and surfaces, to photosensitivity and devices.

The first day included a special session entitled the 'Charles R Kirkijian Symposium on the Mechanical Properties of Glass, a festschrift in honour of Chuck's 75th birthday'. Prof Chuck Kirkijian of Rutgers University, New Jersey gave an interesting talk on the history of fracture mechanics in glass (the people and the theories). With the current interest in nanotechnology there were a few papers on this theme, including 'Supercontinuum and second harmonic generation in amorphous silica nanowires' from Harvard University. Studies showed that 800 nm diameter wires showed good light confinement, with increasing evanescence as the diameter decreased to 200 nm. Light could be coupled into these wires simply by contact with the source fibre. Dispersion increased with increasing diameter, and infrared broadening increased with increasing laser power. Second harmonic generation was also possible in the visible/infrared.

C Rivero of the University of Central Florida showed the Raman amplification properties of tellurite and borophosphate glasses, measured with a novel set-up for bulk samples. The former show Raman gain around 30 times that of silica, and the latter show much wider spectral bandwidth, which can be tailored with the addition of intermediates and network modifiers to the glass. The day's technical sessions concluded with the George W Morey Award Lecture, by Prof Richard Brow of the University of Missouri-Rolla, on 'A new look at phosphate glass', which gave an excellent summary of the influence of phosphate structural and coordination chemistry on glass properties (such as density and refractive index). The day ended with a tour of the University of Central Florida's School of Optics (CREOL) in Orlando.

Tuesday saw the continuation of the Kirkijian Symposium and the sessions on Femtosecond Laser Interactions in Glass; clearly a new and exciting field for producing small scale, accurate waveguide structures in a range of glass compositions, such as silicates and chalcogenides. Prof Angela Seddon of Nottingham University gave a talk reviewing recent developments in erbium (III) doped fluoroaluminosilicate glass ceramics. These materials contain a PbF_2 nano-phase (3 nm crystallites) which erbium partitions to, resulting in flat, broad emission in the 1530 to 1560 nm region. Another fascinating nano-themed talk was given on 'Nanowire formation in arsenic trisulphide' from the Pacific and Northwest National Laboratory. These nanowires were 10 to 100 nm

Continued ▸

in diameter. Their formation depended on surface chemistry, pressure and temperature. Nanowire formation was seen on water washed surfaces, but only As_2S_3 droplets formed on acid etched surfaces.

Wednesday began with an invited lecture from Dr Stan Ovshinsky, co-founder of Energy Conversion Devices, on chalcogenide optical memories in CD/DVD devices. Dr Ovshinsky pioneered the development of this technology, referred to as phase change (PCE) memory, where laser exposure is used to reversibly and rapidly (50 ns) change the local structure (ie crystallise) of an amorphous material. Bond lengths and angles are altered, resulting in changes in absorption and reflectivity. Materials must be used with a rapid transition between the glassy and crystalline states, and co-existence must be possible without phase segregation, eg Ge–Sb–Te. High optical constant differences between both states results in high read contrast. Using materials with the same composition in both states means no diffusion or phase separation in the phase change process, and hence longer life in the final product.

The afternoon was set aside for a tour of the Kennedy Space Center, with sights including a lifesize Apollo 12 rocket, the massive vehicle assembly building, and a few alligators! The student poster competition took place at the end of the day.

Thursday's sessions were a break from the technical content, with emphasis on topics such as ethics, entrepreneurship and intellectual property, at The Kennedy Space Center. Prof M Drews from Clemson University, South Carolina, gave a part historical, part technical talk at the conference banquet in the evening. This was on the conservation of materials from the confederate submarine The H L Hunley, sunk in 1864 and recovered near Charleston, SC in 2000. This event also hosted the awards ceremony of the conference.

The final day of the conference contained a number of excellent papers on photonic crystal or 'holey' fibres, currently another exciting area of glass research. Dr V Kumar from Bath University showed PCFs made from TeO_2 glasses. Extremely low losses have been shown (0·4 dB/m at 1·5 μm by NTT) as only a small fraction of the light travels in the fibre (eg 0·6%). Dr J Sanghera from the Naval Research Labs gave two talks; the first was on chalcogenide optical fibre applications (with loss around 0·1 dB/m), such as electronic countermeasures, surgical laser delivery, spectroscopy (contaminant, tissue near-field), and Raman amplifiers. The second talk was on barium gallo-germanate glasses for vis-IR laser windows for defence applications, which are a cheaper alternative to ZnS (Cleartran). These materials are highly transparent in the near- and mid-IR, strong, with a low dn/dT, environmentally durable, and can form glass ceramics with superior properties.

Prof Frumar from Pardubice University in the Czech Republic gave an invited talk on pulsed laser deposition (PLD) of a number of chalcogenide systems (As–Se, Ge–Se, and various tellurides) with unusual structure and composition. This atypical chemistry is thought to arise due to complex evaporation in the PLD process. Exposure to light and annealing results in a similar structure to bulk glasses, reducing the amount of homo-polar bonds in the glass.

The technical papers from the conference are undergoing peer review before publication in Physics and Chemistry of Glasses and Glass Technology in 2005. ■

Society of Glass Technology,
3rd Floor,
Don Valley House,
Savile Street East,
Sheffield S4 7UQ.
Tel 0114 263 4455.
Fax 0114 263 4411.

STANDARD SAMPLES – LIMESTONE AND DOLOMITE

The Analysis and Properties Committee of the Society of Glass Technology is close to launching two new certified reference materials for limestone and dolomite. There have been 13 contributing laboratories to the analysis so far and progress is very encouraging.

The committee is also working on a revision of the BSI standard on the sampling and analysis of glass making sands. The first part has finished public consultation and is due to be published.

A subcommittee of the Analysis and Properties Committee has a survey of cullet quality and analysis due for publication in Glass Technology and for distribution to the cullet supply chain.

CURRENT STANDARD SAMPLES

The current certified reference materials include amber and green soda–lime–silica glasses; these are available in the form of glass pieces and also as 40 mm diameter discs.

They are intended for the verification of analytical methods, for the calibration of analytical instruments in cases where the calibration of primary substances (pure stoichiometric compounds) is not possible, and for establishing secondary reference materials.

The traceability of this certified reference material is ensured by the use of either stoichiometric analytical techniques or methods that are calibrated against pure compounds.

SGT10 Amber soda–lime–silica container glass (mass%)

SiO_2	Al_2O_3	Fe_2O_3	CaO	MgO	BaO	Na_2O	K_2O	TiO_2	SO_3	Cr_2O_3
72.8	1.62	0.325	10.6-	1.82	0.02	12.2	0.35	0.09	0.05	0.020

SGT11 Green soda–lime–silica container glass (mass%)

SiO_2	Al_2O_3	Fe_2O_3	CaO	MgO	BaO	Na_2O	K_2O	TiO_2	SO_3	Cr_2O_3
70.7	1.83	0.342	10.3	2.14	0.031	13.6	0.69	0.068	0.06	0.205

There are also values for ZrO_2 and Mn_3O_4.

These add to the existing range of standard sand and glass samples for analysis and calibration purposes.

GLASSES

Standard Glass No. 4: Fluoride Opal Glass
Also available as 6 mm thick sheets to special order, price on application.
Standard Glass No. 5: Soda–Lime–Magnesia–Silica Glass
Standard Glass No. 6: Soda–Lime–Silica Glass
Standard Glass No. 7: Soda–Lime–Silica Glass
Two lead glasses were received by the Analysis and Properties Committee but because of time limitations Glass No. 9 was not analysed by all of the collaborating laboratories. This glass has a lower lead oxide content, about 28% PbO, than Glass No. 8 and although it cannot be offered as a certified material, it could be useful as a subsidiary calibration check.
Standard Glass No. 8: Lead oxide–potassium oxide–silica glass (30·59 wt% PbO)
Standard Glass No. 9: Probable composition available.

SANDS

Standard Sand No. 1: 200 g packs at £20.00 plus postage (Al_2O_3 0·061, Fe_2O_3 0·014, TiO_2 0·026).
Standard Sand No. 6: (Al_2O_3 0·06, Fe_2O_3 0·032, TiO_2 0·024)
Standard Sand No. 8: (Al_2O_3 2·07, Fe_2O_3 0·26, TiO_2 0·073, K_2O 1·06)
Standard Sand No. 9: (Al_2O_3 1·35, Fe_2O_3 0·103, TiO_2 0·044, K_2O 0·82)

Orders can be made through the SGT website: www.sgt.org ■