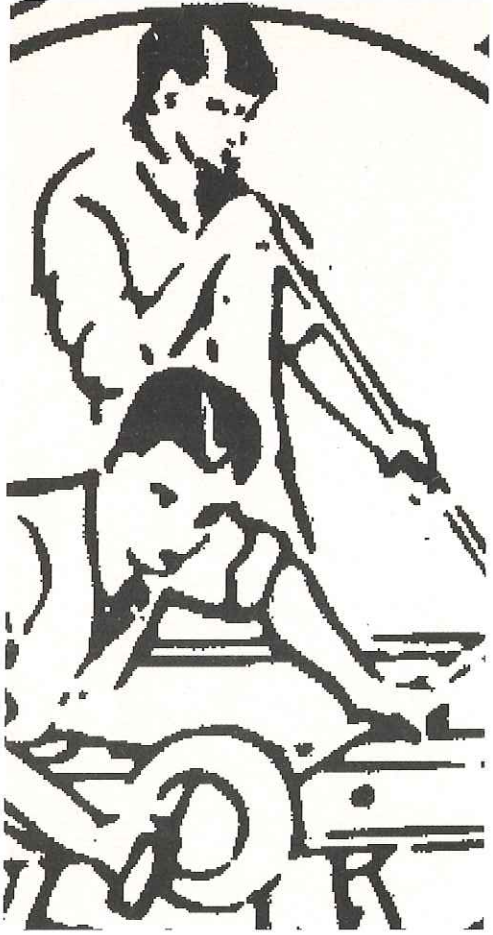

NO. 3 1995

SGT NEWS

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IN PRINT

The June 1995 issue of *Glass Technology* features the first papers from the Society's Spring Meeting on Glass Opportunities, the management of research and development, productivity and quality for a profitable glass industry. Papers included in the June issue are on experimental verification of a stereology-based equation for shrinkage of glass powder compacts during sintering, solubilities of CO_2 in binary alkali silicate and borate candidate glasses for nuclear immobilisation, the origin of colour in iron and manganese-containing glasses investigated by synchrotron radiation and a letter on observations of 'catscratch' cords.

***Physics and Chemistry of Glasses* has papers on basicity and redox equilibria in silicate melts, sub-T_g surface crystallisation of $AgPO_3$ glass, structural role of titanium in silicate glasses, infrared study of AgI containing superionic glasses, Judd-Ofelt parameters of TM3+ in ZBLAN, influence of cooling rate on the thermodynamic properties of silver metaphosphate glass, Raman spectra of aluminophosphate glasses, stress-optic coefficient of heavy metal fluorides, gas bubbles in glass melts under microgravity, application of ultraviolet fluorescence spectroscopy to glass basicity and bismuth gallate glasses.**

Both journals feature a wide range of abstracts from the latest scientific and technical publications.

THE FUTURE OF THE GLASS CONTAINER FURNACE

The possible future of the glass container market, environmental legislation, refractory developments and their implications on furnace design were considered by Graham Gibbs in his talk to a joint meeting of the London Section and the Institute of Refractories Engineers held at United Glass, Porters Wood.

There is, of course, no quick fix or easy solution to the problems facing the glass container industry. The range of solutions facing those responsible for specification and furnace rebuilds is becoming as diverse as the problems they are there to solve.

The market for glass has decayed over the years as the fierce competition provided by plastics and cardboard has taken hold in several market areas. The slide has been halted recently by the promotion of the glass container as a tool for brand enhancement, particularly by the brewers, plus the positive environmental image that the bottle bank network has created. But prices are being squeezed by customers demanding the highest quality glass with the fewest defects that meets the tight dimensional tolerances set by modern high speed filling lines.

Energy prices are also set to increase, especially if there is some international agreement on the carbon tax measures which have to be taken to reduce CO_2 emissions and prevent global warming. The pressure on the container manufacturer is to run operations with the lowest possible capital expenditure and low energy consumption, while producing the highest quality end product.

Environmental pressures have provided gains in energy saving as the proportion of cullet in the batch increases. Batch and cullet preheat also contributes to energy efficiency. Investment in equipment for waste heat recovery is becoming more viable as energy costs increase and technological improvements can be harnessed to recover heat for factory heating, area heating and power generation.

Pollution issues have implications on what goes into the furnace and what fits on at the end in order to satisfy current and future emissions limits. SOx can be controlled by limiting the use of oil and reducing the batch sulphates going into the furnace and with desulphurisation equipment on the way out. NOx can be reduced by using oxy-fuel firing, staged combustion or bleeding natural gas into the regenerator air (Pilkington's 3R process).

Selective catalytic reduction or selective non-catalytic reduction at the flue can also be used but this uses ammonia and involves costly plant and running costs. Particulates are removed by bag filtration, electrostatic precipitators and ceramic filters.

Future furnace options use either conventional, all-electric or unconventional designs. Regenerative furnaces operate very efficiently and meet criteria of

running costs but they also involve high capital expenditure. Bolt-on abatement equipment is available. Its one disadvantage is in the need to reverse, leading to fatigue on the ports and crown and homogeneity problems in the glass.

Oxy-fuel has been expounded at great length and can be seen as the future for the container business. Low capital outlay provides immediate advantages, especially when starting from scratch at a greenfield site. Running costs are dependent on electricity prices; oxygen is around twice the price of the fuel. Desulphurisation and particulate filtration is still needed but the NOx problem is resolved.

The definition of emission limits in terms of concentration rather than mass is a minor regulatory problem which is surmountable. Process control is much more stable, with no reversing needed. Efficiency on IS machines is reported to be improved by 5%.

All-electric furnaces may not produce the same level of pollutants but the cost of electricity in a country without extensive nuclear or hydroelectric resources and a reliance on carbon-based fuels means that prices would be too high to justify its adoption by container manufacturers.

Unconventional melting options include the Seg melter, which uses electricity, the advanced glass melter, which has good potential for single machine short runs but not bigger operations, and the plasma melter, which is too specialised.

The regenerative furnace is still the preferred option for container manufacture. When combined with new waste heat recovery technology, better refractories and insulation, its future still has great potential. Further design improvements can also be tuned to help performance. The oxy-fuel option is looking more viable for the next generation of furnaces. ■

Society of Glass Technology, 20 Hallam Gate Road, Sheffield S10 5BT. Tel 0114 2663168. Fax 0114 2665252.

BORATE GLASSES, CRYSTALS AND MELTS

The Second International Conference on Borate Glasses, Crystals and Melts organised by the Society of Glass Technology will be held in Abingdon on 22–25 July 1996. The conference follows that on Borate Glasses held at the New York State College of Ceramics at Alfred University, New York in 1978 and is devoted to the structure, properties and technology of borate-containing glasses, crystals and melts.

The conference is in honour of Professor Philip J Bray, in recognition of his outstanding contribution to the science of borates. Professor Bray will open the conference with a plenary lecture, followed by a session on NMR and NQR techniques. Other topics to be included are: Glass forming systems; borate-containing melts; thioborate systems; structural studies including crystallography, structural modelling and computer simulation; crystallisation; structure–property relationships; ionic transport including the mixed alkali effect; superionic conduction; multi-component systems including borosilicates; industrial glasses and applications; and borate glass technology.

Conference co-chairmen are:

Steven A Feller, Department of Physics, Coe College, 1220 First Avenue NE, Cedar Rapids, IA 52402-5092, USA. Tel 319 399 8633. Fax 319 399 8748. E-mail sfeller@coe.edu.

Adrian C Wright, J J Thomson Physical Laboratory, University of Reading, Whiteknights, Reading RG6 2AF, UK. Tel 01734 318555. Fax 01734 750203. E-mail a.c.wright@reading.ac.uk

A call for papers will be circulated in autumn 1995 and the abstract deadline is 31 January 1996. Any further enquiries and requests to receive the second announcement should be sent to Jill Costello at the Society of Glass Technology, Sheffield. ■

CLINIC MEETING—POTS

A clinic meeting of the Hand Made Committee is to be held on 4 October 1995 in the Stourbridge area. Main areas of discussion include: Which pot material gives the best glass?; arching, firing and glazing; how do glass compositions affect pot life?; open versus closed; and why do your pots fail?

Further details of this meeting and the activities of the Hand Made Committee can be obtained from Jill Costello at the Society of Glass Technology in Sheffield.

TECHNICAL COMMITTEE NEWS

The recent merger of the Chemical Durability and Chemical Analysis Committees and subsequent amalgamation with the Physical Properties Committee to form the Analysis and Properties Committee is the major change in the list of Technical Committees of the Society. The new Analysis and Properties Committee is preparing an inventory of standard samples held by the Society and is finalising the certificate of analysis of two new sample sands which should be available soon.

Changes in personnel and the new telephone codes are included in the updated list below.

Analysis and Properties Committee
Chairman: Mrs H M West (0114 253 3401)
Secretary: Miss R M Sales (0114 230 6179)

Basic Science and Technology Committee
Chairman: Mr H W McKenzie (01695 54270)
Secretary: Dr D Holland (01203 523 396)

Engineering Committee
Chairman: Mr A Humphries (01246 277 288)
Secretary: Mr T Stevenson (01709 828 141)

Furnace Committee
Chairman: Mr G Hardcastle (0179 828 141)
Secretary: Mr B Brightmore (01782 786121)

Hand-made Glassware Committee
Chairman: Mr J Henderson (0191 264 4775)
Secretary: Mr E Booth (01384 295 758)

Refractories Committee
Chairman: Mr J R Osborn (01226 731 414)
Secretary: Mr A Varney (0114 236 4927)

SENSORS AND CONTROL IN THE GLASS INDUSTRY

The North American Section has organised a one day meeting on 9 June 1995 in Cleveland, Ohio. Papers on sensors and controls will be presented in the morning session, followed by a visit to Ferro Corp in the afternoon.

Further details can be obtained from Dr Alix Clare, Tel (USA) 607 871 2425 or Fax 607 871 2392.

SGT NEWS

FURNACE MODELLING ASSISTS PERFORMANCE IMPROVEMENT

Modelling furnace design changes are essential for the continued improvement of performance. Laidlaw Drew has been active in simulating the furnace using traditional perspex models, modern computational fluid dynamics and improvised methods for troubleshooting. Neil Simpson and Stephen Auld described the simulation methods to a joint meeting of the North West Section and the Institute of Materials North West Ceramics Group.

Models of furnaces serve three main tasks: Design, in which combinations of ports and burner types are examined; project development, the investigation of the effect of various changes; and troubleshooting, reacting to unplanned events. Perspex modelling tanks using water with an injected dye have become the standard simulation method. Cross-fired furnace models provide a cross-section of the furnace incorporating the regenerator and ports. End-fired furnace models provide the viewer with the whole melting area for observation.

Dye is injected into the water entering through the burner ports. This then circulates around the model until the clear water disappears. When the water is completely coloured, the dye source can be turned off and the observer can again see the circulation patterns as clear water displaces the coloured. Video cameras can be used to record the flow patterns for further examination.

A development of the dye system uses an acid and alkali to represent the combustion air and gases, respectively. An indicator solution can then be used to identify acid- and alkali-rich regions and the shape of the reaction area while keeping the same recirculation patterns. Concentrations of the acid and alkali can be changed to model different combustion ratios and oxy-fuel systems.

The problem with the perspex models is their general inflexibility. They have to be either broken to be modified or several models of the same furnace have to be made, each incorporating small changes. No furnace is exactly the same, so each model is itself unique. There are also problems with quantitative accuracy. A video recording is a subjective method of investigation and the model is isothermal which limits the accuracy of any results. Therefore, computational fluid dynamics (CFD) ought to give

CONTINUED ►

ELEVEN NEW FELLOWS

The joint North West Section Golden Jubilee Dinner and Dance and Society Annual Dinner and Dance, held at the Prince of Wales Hotel, Southport, saw the presentation of eleven Fellows to the Society. Pictured (left to right) top: Dr James Barton, St Gobain Recherche; Dr Adrian Wright, Reading University; Dr Peter Sewell, Pilkington Technology Centre; Howard McKenzie, Pilkington Technology Centre; Dr Ian Smith, Pilkington Technology Centre; Dr Roger Kent, consultant; Professor Michael Brungs, University of New South Wales; Gordon Roberts, Ferro Corp; Roy Nickels, President, Society of Glass Technology; Alev Yaraman, Turkiye Sise ve Cam Fabrikalari; Professor Helmut Schaeffer, Deutsche Glastechnische Gesellschaft; and Peter Gibson, York Glaziers Trust.

LOCAL SECTION CONTACTS
For details of forthcoming local section events in your area, contact the following. All SGT members and non-members welcome.

London
– Mr T Ensor, United Glass Ltd, Porters Wood, St Albans, Herts AL3 6NY. Tel 01727 59261

Midlands
– Mr R W Fisher, MRJ Furnaces, Unit 94, Heming Rd, Reddich, Worcester B98 0AE. Tel 01527 529810.

North East
– Mr J Henderson, 44 Woodside Ave, Throckley, Newcastle upon Tyne NE15 9BE. Tel 0191 264 4775.

North West
– Dr D Martlew, Pilkington Technology Centre, Hall Lane, Lathom, Ormskirk, Lancs. Tel 01695 54210

Scottish
– Mr D A Rennie, United Glass Ltd, Glasshouse Loan, Alloa FK20 1PD. Tel 01259 218822.

Yorkshire
– Miss R M Sales, 20 Blackbrook Drive, Sheffield S10 4LS. Tel 0114 2306179

better results when modelling the furnace and simulating combustion.

Laidlaw Drew has investigated the use of CFD to model both cross-fired and end-fired furnaces with the assistance of its teaching company associate Stephen Auld from Napier University. The company used the FLUID computer code to model fluid flow and combustion reactions within a finite volume defined by 150 to 5000 nodes. A Sun SPARC Station or HP9000 workstation costing around £20,000 is needed to run the FLUID program, which itself costs around £35,000 for the full code or £14,000 on an annual licence.

The main problem associated with computer modelling is the amount of time taken to generate a reasonable model of the gas flow, temperature profile and water molecule fraction. An end-fired furnace is particularly sophisticated with a wide number of velocity vector plots. Burner modelling is simpler but the mathematics behind simulating the air flows and lift off of the flame is still highly complex.

CFD has great potential to simulate the furnace but the computing time using a dedicated workstation for an isothermal flow model may be 24 hours. A combustion model may take two weeks to process! The odd freak result that turns up also weakens confidence in the method. Laidlaw Drew is not committing itself entirely to computer-based modelling and is continuing with solid furnace models.

Troubleshooting the odd customer query with Laidlaw Drew's range of burners, nozzles and oil atomisers requires novel and improvised methods of investigation. Water atomised by compressed air gives an observer a good feel of particle size distribution, a stroboscope can be used to see large particles. Areas of recirculation can be checked, a flour and water mixture can produce a fine mist which creates a visual impression of vertices. An apiarist's bee smoker, sawdust and a feather duster are all tools which may just provide the right degree of insight needed to solve a particular client's problem.

Perspex models, especially acid/alkali versions, are used for the majority of furnace and port design work. It was hoped that computational fluid dynamics would replace or partly replace the perspex model but its limitations have been demonstrated through four years of modelling known systems. CFD provides a pretty picture but it is not the full design tool it had been promoted as. Academics at Napier University are now working on overcoming its limitations. ■

SOCIETY GATHERS IN SOUTHPORT

The Society's Spring Meeting, held in Southport this year, was well attended. The theme of the meeting was glass opportunities and delegates from around the world heard talks on topics ranging from the latest manufacturing techniques to high technology glass applications.

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UK GO COMPUTER-BASED DISCUSSION GROUP

As an extension of the UK GO special interest group, a computer-based discussion group has been established which will allow ongoing discussion between researchers at universities and in industry who are working on glasses for opto-electronics.

Computer users with e-mail facilities can subscribe to the discussion group through a service called Mailbase. Mailbase provides an enhancement to e-mail, which is normally a one to one means of communication, by bringing together groups of individuals with common professional interests. The e-mail addresses of the group are held on a mailing list; by sending one message to a central address all of the group can be contacted.

The system has many features but one particularly useful facility is the archiving of messages. All messages sent to a list are stored centrally. When you first join a list you can retrieve some of the old mail to check how the list is used. Also, if you have deleted a message which you later require it can be recovered from Mailbase very easily.

To subscribe to the UK GO discussion group, send this message 'join GLASS-UKGO <your first name> <your last name>', to 'mailbase@mailbase.ac.uk'. You should then be sent an introductory file with further details.

By joining the group, you are not committing yourself to answering every enquiry which is posted, nor are you guaranteed that your queries will be answered. This is intended to be an open forum where people are free to ask questions and give answers or suggestions if they are able.

INFORMATION SYSTEMS

The Engineering Committee has organised a joint factory visit and clinic meeting on Wednesday 7 June. The day begins with a visit to Mass Measuring Systems in Manchester, followed by a buffet lunch and clinic discussion chaired by David Clough of Eurotherm Process Automation at the Rudyard Toby Hotel, Chapel Heaton, Stockport.

Further details can be obtained from Jill Costello at the Society.