

COORDINATING TECHNICAL COMMITTEE ANNUAL REPORT 2019

CTC CHAIR



E-mail: inoue@iis.u-tokyo.ac.jp

CTC MEMBERS



R. Hand
(Secretary)



B. Hehlen



J. Jones



M. Hubert



H. Sesigur



L. Zheng



J. Parker

1. Executive Summary.....	2
2 Summary of R&D Activity Fields & TC Activities.....	14
2.1 BASIC GLASS SCIENCE – Coordinator: B Hehlen	14
2.2 GLASS PRODUCTION – Coordinator: Hande Sesigur	14
2.3 CHARACTERISATION – Coordinator: Mathieu Hubert	18
2.4 APPLICATIONS – Coordinator: Julian Jones	20
2.5 INFORMATION, EDUCATION, HISTORY – Coordinator: John Parker.....	24
3. Organisational issues.....	27
4. Reports of the activities of individual TCs.....	33

1. Executive Summary

A business meeting took place on 9th June, 2019 in Boston, USA, during the ICG Congress. In addition to this meeting, telephone conferences amongst the CTC members were organized bimonthly.

The meetings focused on a summary of activities, presented by the cluster coordinators. The Steering Committee decided to provide financial support to stimulate the development of new actions in the TCs. Several special events, such as expert workshops and schools, were organized. The CTC followed and evaluated the outcome of such events.

The CTC monitored the activity of the TCs and took care of the necessary adaptations of the TC structure.

1.1 Cooperative actions of the technical committees

The main actions performed by TCs are Round Robin tests and organization of conferences and symposia. A complete description of these cooperative actions is given in the following sections. The Summer and Winter Schools are written up as press releases for advertising purposes. Abridged versions of these press releases are presented below.

1.2 ICG Schools

This year marked the 11th Anniversary of the ICG Summer School in Montpellier, France, the first North American Summer School on Photonic Materials, at Université Laval, in Quebec City, Canada, and 5th ICG Winter School at the Wuhan University of Technology, China.

11th Montpellier ICG Summer School

The 11th Summer School began on Sunday 7th July 2019 following a heat wave in France which had broken many local temperature records and coincided with the final of the FIFA Women's Football World Cup. Inevitably transport issues affected a few participants and several did not arrive until lunchtime on the first day of lectures. The total attending again continued the slow upward trend and included people from further afield than previously. Another feature was the very high proportion of female attendees.

The course had two streams: basic science and waste immobilisation. The later stream followed a similar pattern to that in Wuhan with the lectures arranged with the help of ICG's technical committee TC05 and its chair: Olivier Pinet (CEA, Marcoule).

The pattern of the week was to use the mornings of the first four days for lectures, four per day and we would like to thank our lecturers who give of their time without charge (in order of presentation): a) on the Basic Science Option J. Parker, R. Conradt, R. Hand, J. Deubener, P. Florian, L. Cormier, B. Hehlen, A. Takada; b) on the Hazardous Waste Vitrification option: M. Ojovan, O. Pinet, R. Pokorny, S. Peugeot, D. Perret and S. Gin. Afternoons were devoted to other activities. On Monday, all the students were asked to give a short presentation (3 minutes) to explain the subject of their day job including the equipment they were using.

On the basis of students' interests they were allocated to a 6 membered team and set a task to be solved by the end of the course. The formal launch of the projects took place at the beginning of Tuesday afternoon with the rest of the afternoon being used to formulate how they might tackle the issues raised. The project subjects were wide ranging and open ended; they were also designed to be a part of the teaching content of the course.

These projects shared the Wednesday and Thursday afternoon time slots with one hour tutorial sessions linked to the lectures on the course. The tutorials 'under the pine trees' were intended for smaller groups than the lectures and designed to be more interactive. This year 5/6 different tutorial sessions each an hour long were arranged. Since the timetable only allowed two tutorial slots students had to select those they were most interested in and also had the option to continue working on their projects. Friday morning was devoted to student presentations. Each of the seven groups was limited to 15 minutes with 5 minutes for questions.

First North American Summer School on Photonic Materials

From June 16th to the 21st, the Centre for Optics, Photonics and Lasers (COPL) at Université Laval, in Quebec City, Canada, hosted the first North American Summer School on Photonic Materials, which was organized under the auspices of the ICG. The School had 80 participants from 13 different countries and was co-chaired by Younès Messaddeq (Université Laval), and Kathleen Richardson (University of Central Florida).

The participants were graduate students and early career scientists. The school combined morning lectures given by some twenty recognized scientists and afternoon laboratory projects carried out within COPL's research infrastructure. Through funding from public (US and Canadian government and university) and private corporate, professional society and foundational) sources, all participants received some form of support allowing them to attend.

All students participated in a group laboratory project. Students were required to submit a one page (written) project summary (to receive their final participant certificate) and to present as a team a 15 minutes oral presentation. These presentations were high level, illustrating the student's backgrounds, goals of the effort, and outcomes during the School's final afternoon session on Friday. As the projects were varied in topic area, efforts to diversify the teams (in level, background and gender) were made. Project presentations were subjected to evaluation from by a 4-member jury (made up of speakers) who ranked the students for technical and professional skills. Sentinel Nord (the Center of Excellence supporting the inter-disciplinary effort in Canada on Photonics in Energy, Environment and Medicine) generously awarded a best team award to the 2 groups had the top equal team score totals.

This NASSPM school has filled a void in the geographical distribution in the ICG education events. North America (Quebec) is the third point after Europe (Montpellier) and China (Wuhan), allowing ICG to enhance and widen the education effort and impact on glass training. ICG welcomes this welcome initiative and hopes it is continued in next years.

5th ICG Wuhan Winter School for young researchers

This year the school concentrated on the theme of Glass Science, attracting 26 students. While fewer than previously because there was no parallel theme there was no shortage of quality among those that gathered at the Vienna International Hotel near Wuhan University of Technology.

Seven Chinese Institutes and Universities were represented among the student group. Four of the students had travelled from Europe (Denmark, Germany and UK); they each had received generous scholarships providing travel and accommodation support from China Triumph International. The company was represented throughout the event by Mrs. K. Wang, assistant to the director as well as Executive Secretary of ICG.

The teachers on the course had a strongly international flavour. Lectures were given by R. Conradt (Germany), A. Goel (USA), H. Inoue (Japan) JinJun Ren (China), J. Parker, (UK), A. Takada (Japan) R. Vacher and B. Hehlen, (France) and Yuanzheng Yue, (Denmark and China). Their contributions were all much appreciated by the students.

On the Monday and Thursday an introductory social event and a final dinner were arranged. On Thursday afternoon while the students were working on their projects, lecturers were taken to visit a local park which had been designed to illustrate the flora of different regions in China and which was still amazingly colourful in spite of the approach of winter.

Following previous practice, the students undertook a range of projects as a key part of the activities. These again proved popular not only because of the glass technology they learn but also because of the opportunity given to practice their language skills, to speak to a large audience and to network. The winning group comprised: Guang Feng, Jin Yu, Linyuan Jia, Lutao Liu and Meng Zhang and they described a system they had developed on paper, using optical fibre-based monitoring of remote weather sensors. Throughout the event a team of local students and staff provided efficient and effective support to ensure the smooth running of the school. A 6th Winter School again in Wuhan was planned.

1.3 Activities of other TCs

Individual TCs have met as follows

TC01:

For the first time the ICG Congress organisers displayed TC posters electronically. TC chairs submitted Powerpoint displays with detailed information about their activities.

A0 posters and A5 leaflets advertising TC activities, books and schools were circulated specifically at the Boston Congress and for the Vitrum Trade Fair in Milan in October.

CTC initiated a fresh approach by encouraging each TC chair to produce a one-minute video advertising their committee. 6 videos were submitted and collated by CTC vice-chair Prof Jones for display throughout the congress.

During the past year TC01 published 18 press releases, including one for the ICG2030 Project. ICG press releases were widely distributed by Dr Klaus Bange and made available for publication in other journals and e-media.

TC02:

TC02 met in April 2019 in Brussels; a telecon was held in November 2019.

TC03 & TC26:

Two joint symposia were held at ICG Boston: 1) Structure of glass: network formers and network modifiers and 2) Glass and melt: macroscopic properties and structure of melt at high temperature.

TC04:

The result of TC04 Round Robin bioactivity study, which was carried out over 9 institutions and 7 countries, is available online. The aim of the study was to design a simple and reliable protocol which researchers can use to evaluate the ability of their bioactive glasses, or variants, to precipitate calcium-phosphate crystals such as apatite on their surface.

TC05:

TC05 (specifically Olivier Pinet, Ashutosh Goel and Kai Xu) organised a session on waste vitrification at ICG Boston that included 60 oral presentations and over 10 poster presentations. TC05 members organized the MRS linked meeting: "Scientific Basis for Nuclear Waste Management" Vienna, Austria (Michael Ojovan) and a session on "Ceramic materials for nuclear energy" at the 13th Pacific Rim Conference of Ceramics Societies (Kevin Fox).

TC05 was involved in two educational courses. The first was organized by Olivier Pinet at the 11th ICG Montpellier Summer School, held July 8-12, 2019, in Montpellier, France, including eight waste vitrification lectures covering topics including glass formulation, glass property modeling, glass melting, and chemical durability. The other was provided at the Joint ICTP-IAEA International School on Nuclear Waste Vitrification in Trieste, Italy from September 23-27, 2019. This event, organized by Michael Ojovan, included 27 invited lectures on technological approaches of nuclear waste vitrification, glass formulation, glass corrosion and radiation damage effects in glass. 17 participant talks from a variety of countries including Great Britain, France, the United States, Italy, China, Ukraine, Croatia, Iran, and others, were presented.

TC06:

A business meeting was held at ICG Boston.

TC07:

TC07 organised a session on crystallisation of glasses and glass ceramics at and held a business meeting at ICG Boston. TC07 members were also involved in the organisation of other sessions at ICG Boston.

TC09:

A business meeting was held at ICG Boston.

TC09 is developing a set of recommended best practices for defining energy use and efficiency so that companies within each glass sector can make useful comparisons. The approach will be used to explain some of the differences in performance between sectors and aid discussions with non-technical and/or external agencies. The results of this project will be used to explain the energy balances of glass furnaces and to evaluate the methodology of applied energy balance models, measuring techniques and benchmark data.

A round robin comparison on calculating the Thermodynamic Energy Requirement for glass melting for some selected glasses is being undertaken.

TC12:

An open session on Glasses for Pharma was organized at ICG Boston this included 6 presentations and a round table discussion.

In 2018 a new testing activity on delamination was started with the aim to test, using the TC12 protocol for predicting the propensity for delamination of vials. The Round Robin was completed in November 2019. The results are being written up for publication.

TC16:

TC16 met twice in 2019 once at ICG Boston and later in the year in St. Petersburg.

In the CTC-funded collaborative research project “Nanocrystalline sol-gel coatings for solar energy applications”, the sol-gel method was used to prepare multi-component films with a complex structure, including photonic bandgap multilayer architectures. Down- and up-converting coatings containing rare earths and solar-control coatings have been developed.

TC17:

A successful one day session was organized at ICG Boston with 18 oral presentations and 4 posters. The subjects covered included the relationship between faience and glass, recipes for Iron Age glass beads from Anatolia, analysis of glass beads from Mozambique, impact of bacteria on Medieval stained glass windows, care and conservation of historical glass collections in Europe and the U.S., solarization in soda-lime-silica glasses, comparison of an analog Iron Age glassy matrix for construction for applicability to nuclear waste storage, report on the last surviving traditional tank furnaces in India. Analytical studies also examined the use of Portable Laser Ablation, and SIMS to evaluate the composition of 19th C. historical glasses. There were 3 invited speakers.

TC17 also contributed to a Workshop on Ancient Indian Glass held in January 2019.

TC18:

TC18 met during ICG Boston. The Committee was involved in the organization of the “Glass Technology and Manufacturing Session / Raw Materials, Batch Melting, and Fining” session at ICG Boston. A project on batch melting kinetics is ongoing.

TC19:

The TC19 organized a session on Glass Surfaces at ICG Boston. The invited speakers were Paula Clark (Tascon), Temel Buyuklimanli (EAG), Volker Rupertus (Schott), Robert Schaut (Corning), Nick Smith (Corning), and Nikolas Podraza (Univ. Toledo). These invited speakers and other general contributions discussed state-of-the-art developments in surface analysis as well as surface science issues in pharmaceutical and display glasses. A business meeting was also held at ICG Boston.

TC20:

TC20 was involved in the 1st North American Summer School on Photonic Materials (NASSPM) detailed elsewhere in this report.

The 21st International Conference on Transparent Optical Networks (ICTON 2019) was held in Angers (France) on 9-13 July 2019. Several TC20 members participated with invited presentations

The 8th International Workshop on Photoluminescence in Rare Earths, PRE'19 and flag event of TC20, was held in Nice, France, in September 2019. 4 prizes and 2 certificates were awarded to the best young presenters of oral and poster communications. The money prizes were offered by ICG through TC20, the certificates and the accompanying books were offered by Fotonica.it.

TC21:

TC21 held meetings at both the International Seminar on Glass Furnace Design and Operation in Velke Karlovice CZ and the ICG Congress in Boston, USA.

TC21 conducted Phase I of a round robin test for modeling a small cold top electric glass melter with C-glass. The geometry description and necessary data to develop a full 3D CFD model was compiled and distributed to the TC21 members. Results from several members were presented at the 2019 meetings.

TC23:

As well as the ICG Summer and Winter Schools and the Photonics Summer School detailed elsewhere in this report, training sessions were conducted in Brazil in the course "Techniques in Glass Production" were continued and new topics of Glass Furnaces in the Glass Industry, Refractory Manufacturing Process, and Manufacturing and transformation processes of the Glass Industry were covered. This training was performed through visiting the AGC float glass company, in Guaratinguetá, S.P. and the "Glassvale" transformation glass industry, in São José dos Campos, S.P.

TC26:

2 joint sessions were held with TC03 at ICG Boston (detailed above).

TC26 has developed a database of Raman spectra which can be found at: <https://odr.io/ICGlassVib>

TC27:

TC members organized and chaired the Modelling and Simulation sessions at ICG Boston. The TC Chair co-organized and co-chaired the Glass and Optical Materials Symposium during MS&T 2019 in Portland, Oregon.

Youth Outreach Committee:

The ICG Youth Outreach Committee partnered with ACerS PCSA (President's Council of Student Advisors) to organize an "Early Career Networking Event" at ICG Boston. Lunch was kindly provided to all participants by ACerS.

More than 50 students and early career professionals registered for the occasion. Alicia Duran, President of the ICG, opened the event and shared her vision of the ICG, highlighting the opportunities the glass community offers, and emphasizing the key role the next generations of glass scientists and engineers will play for the future of glass and its impact in our societies.

Following this introduction, a panel of professionals from Academia, Industry and National Labs shared with the audience their experience in the glass world. Each of the mentors presented a slide summarizing their work, background, favorite thing about glass, and shared tips for a successful

career, illustrating them with anecdotes from their own career experience. The mentors included Erik Muijsenberg (Glass Service Inc), Randy Youngman (Corning), Satoru Tomeno (Asahi Glass Co.), Kathleen Richardson (Univ. of Central Florida), Delia Brauer (Univ. Jena), Tayyab Suratwala (Lawrence Livermore Nat. Lab), John McCloy (Washington State Univ.), Rebecca Dylla-Spears (Lawrence Livermore Nat. Lab), Liping Huang (Rensselaer Polytechnic Institute), and Mathieu Hubert (Corning).

1.4 Publications

TCs have been involved in the following publications

TC01:

The initial print run of Teaching Glass Better was 1000 copies and these have now been sold. The normal distribution routes for ICG books has been through DGG and SGT, but the Chinese and Japanese Ceramic Associations have also become suppliers. Copies can also be preordered for delivery at an ICG conference. ICG has also considered an alternative distribution route through Amazon and an e-copy of Teaching Glass Better is under discussion.

TC04:

TC04 Chair Delia Brauer has been invited to edit a book on Phosphate and Borate Bioactive Glasses, to be published by the Royal Society of Chemistry; several TC04 members have been invited to contribute chapters.

A Special Issue "50 Years of Bioactive Glasses" has been now published in the journal Biomedical Glasses. More than 15 papers were submitted to this special collection, many of them by TC04 members. All papers are open access.

Amy Nommeots-Nomm, Delia Brauer, Leena Hupa and Dana Rohanová have published a review paper on acellular immersion studies on bioactive glasses, published in a Special Issue "Women in Glass" in the International Journal of Applied Glass Science.

The 3rd edition of Wolfram Höland's text book on Glass-Ceramic Technology has been published by Wiley.

Former Chair Julian Jones has written an article on Glass for Regenerative Medicine, discussing the use of glass in healing injuries, published in the April 2019 issue (page 44) of Glass International.

Wolfram Höland and Markus Rampf have submitted a book chapter "Glass-ceramics for dental restorations" to be included in: K. Pawelec (ed.), "Bone repair biomaterials: Regeneration and clinical aspects" (2nd ed.).

Many TC04 members are involved in the open access journal Biomedical Glasses. Notably Aldo Boccaccini (editor-in-chief), Julian Jones, Delia Brauer, Chengtie Wu, Jonathan Massera and Mohamed Rahaman (associate editors). Several other TC04 members are on the editorial board.

A documentary from the Discovery Channel entitled Bioglass and The Human Body featuring Julian Jones is on You Tube.

TC05:

A virtual special issue (VSI) entitled "Vitrification and geopolymerization of industrial wastes" was published in Materials Letters. This VSI originated from the TC05 sponsored scientific meeting focused on industrial wastes and their vitrification, which was held at University "Miguel Hernández" in 2017.

TC07:

The joint TC07 paper "Updated definition of glass-ceramics" was honoured by the Journal of Non-Crystalline Solids with "The 2018 Most downloaded article Award".

TC16:

R. Almeida, L. Santos and A. Martucci are editors of "Sol-gel derived optical and photonic materials" which will be published by Elsevier in 2020. A. Duran, S. Ribeiro and J. Xu are contributing with a chapter.

TC20:

A Special Issue of the journal Optical Materials was published in January 19, including selected, peer-reviewed, papers from the PRE'17 Workshop. The Guest Editors were Dominik Dorosz, Giancarlo C. Righini, Maurizio Ferrari, and Laeticia Petit. [<https://www.sciencedirect.com/journal/optical-materials/vol/87>]

A book on Glass Micro- and Nanospheres: Physics and Applications was published in September 2019, edited by Giancarlo C. Righini.

A Special Issue of the journal Ceramics International is collecting papers from the PRE'19 Workshop. Submission is open, and the deadline is set at December 1st, 2019. The Guest Editors are Wilfried Blanc and Giancarlo C. Righini, together with Pieter Dorenbos and Fiorenzo Vetrone.

TC23:

The four volumes of our comics in Japanese style "Manga" were translated into English by TC23 Activity. [http://www.icglass.org/images/files/44-hq1_glass-world_2nd-version-for-upload-compactado-1.pdf, http://www.icglass.org/images/files/44-hq2_glass-recycling_2nd-version-for-upload-compactado-1.pdf, http://www.icglass.org/images/files/44-hq3_glass-recycling_2nd-version-for-upload-compactado-1.pdf, http://www.icglass.org/images/files/44-hq4_glass-recycling_2nd-version-for-upload-compactado-1.pdf]

TC27:

Chair of TC27 contributed a book chapter on "Molecular Dynamics Simulations of Oxide Glasses" for the Handbook of Glasses will be published by Springer.

Chair and member and Alastair Cormack are still working on the "Computer Simulations of Glasses: Fundamentals and Applications" with Wiley.

TC28:

The book entitled "Fiberglass Science and Technology: Chemistry, Processing, Characterizations, Applications, and Sustainability" has been finalized. The entire manuscript will be submitted to the Publisher in April 2020.

1.5 The 25th International Congress on Glasses

From 9-14th June the Boston Park Plaza Hotel and Towers, USA became the venue for the 25th International Congress on Glasses. The Congress was hosted by the American Ceramic Society and Optical Materials Division working with the International Commission on Glass.

The Congress Chairman was Prof. Richard Brow of Missouri University of Science & Technology, Program Chair was Prof. John Mauro of Pennsylvania State University. The opening ceremony began with welcomes from the ICG president, Dr. Alicia Duran, the Congress Chairman was Prof. Richard Brow of Missouri University of Science & Technology and Dr. Liping Huang, Rensselaer Polytechnic Institute. Next followed an Awards Ceremony. First were the prestigious President's Awards given to: Dr. M. Choudhary (USA) and A. Kirman (TR). Secondly the Turner Prize was awarded to: Dr. Michael Dunkl (TC11) and Dr. Jincheng Du (TC27). Dr. S. Zhou (CN) gave a plenary presentation entitled 'Multicomponent Photonic Glasses and Fibers' as a winner of the Gottardi Prize 2018. Dr. M. M. Smedskjaer (DK) was the recipient of the Gottardi Prize 2019 and he later gave a plenary presentation entitled 'Toward intrinsic damage resistance and ductility in oxide glasses'. The Weyl award was presented to Dr. Thomas Douglas Bennett (UK) who subsequently spoke on 'Metal-organic framework liquids, glasses and blends'.

Altogether, 906 people registered for the Congress of whom 466 were from the USA. The 440 international participants represented 39 countries. 200 of the attendees were students. There were 703 oral presentations including 212 invited talks. A special event of the congress was the Honorary Symposium of Professor A. K. Varshneya Festschrift. Dr. Varshneya, Emeritus Professor of Glass Science and Engineering at Alfred University and President of Saxon Glass Technologies has dedicated nearly six decades of his life to the advancement of glass science, engineering, and technology. The symposium centered on him was held from June 11th to 14th.

The Stevanato Group provided invaluable support by sponsoring the poster competition. Altogether 135 posters were presented and covered a wide range of subjects. Prizes were awarded to: Maria Helena Ramirez (Brazil), Junjie Zhao (China), Kuo-Hao Lee (USA), Moritz Fritzsche (Germany) and Zhen Zhang (France).

The Poster and Young Speaker prizes were distributed during the closing ceremony and were followed by a formal handover to the Deutsche Glastechnische Gesellschaft e. V. who will organise the 26th Congress in Berlin, where we were promised a warm welcome.

1.6 Turner Award

The Turner Award was given jointly to Dr. Michael Dunkl (Germany) and Dr. Jincheng Du (USA).

Dr. Dunkl has long experience in the glass and refractory industry. Dr. Dunkl became a member of TC11 in 1987 and from 1993 till 2001 worked as chair for TC11 and later as chair again from 2007 to 2016. He has more than 50 publications in the field of refractories for glass melts presented at many important glass conferences, such as UNITECER, and technical magazines worldwide. In the 1990s he has developed testing procedures for corrosion and exudation of fused cast materials. Nowadays these procedures are used worldwide and well-known as "TC11 procedures".

Dr. Du has served as the TC Chair of TC27 since 2011 and has done an outstanding job in running and promoting the TC. He has organized a series of Challenge Workshops on Molecular Dynamics Simulations of Glasses and Amorphous Materials. He also actively participated in the ICG CTC activities and interactions with other TCs. Dr. Du is a known and active researcher in his field of atomistic simulations of glasses with strong interactions with both academics and industry. He currently serves as the Vice Chair of the Glass and Optical Materials Division (GOMD) of American Ceramic Society.

1.7 The Best TC Websites

The best TC websites as judged by the CTC were TC09: Energy Efficiency and TC23: Education. The prize consisted of a 700 Euro (max) contribution to a dinner for the members of the winning TC.

1.8 ICG fund for 2020

CTC offered financial support up to maximum 4000 Euro to each TC. The members of the CTC evaluated the applications of three TCs which were selected using an agreed procedure. The TCs and the actual amounts of support are shown in the table. A report of the use made of the funding was required for the annual report.

Results of the amount of the support

Technical Committee	Decision
TC17: Archaeometry The grant will be spent entirely on the copy editing, layout, and printing of the proceedings of the Archaeometry of Glass Session at the XXV ICG Triennial Congress, which included 3 invited speakers, 18 oral presentations and 4 posters.	CTC requested to examine the publication of the proceedings as a special issue of a journal and reduction costs. The amount was undecided.
TC20: Photonic Glasses and Optical Fibers 1) The grant will be support a few students/postdocs attending the 2020 ICG Annual Meeting in Krakow, Poland. TC20 will organize a "Young Scientists and Technologists Session" at the ICG Meeting, related to the topics of photonic glasses and optical fibres. 2) TC20 will hold the meeting for the preparation of the International Year of Glass and for activities in ICG2030 just before or after the ICG Annual Meeting. The amount will be used for a partial support of TC20 members.	CTC allocated 2500 Euros for young participants for Annual meeting. The decision of another support was postponed.
TC27: Atomistic Simulation TC27 will organize the 4th International Workshop on Challenges of Atomistic Simulations of Glasses in U.S.	CTC requested a summary article to bring the outcomes of the meeting to a wider community or a web

CTC financial support will cover local expenses of the invited speakers together with the fund by the local host or other sources. archive of the materials. and allocated 4000 Euros

1.9 Annual Reports

CTC again asked TC chairs to place their annual reports directly onto the ICG web site. The website provides an up-to-date summary and review of overall ICG activities. CTC again asked TC chairs to place their annual reports directly onto the ICG web site. Here is a list of TCs belonging to each cluster and their chairs.

Cluster	Cluster Chair	TC number & name	TC Chair
Basics	Bernard Hehlen	TC03: Glass Structure	Daniel Neuville
		TC07: Crystallisation & GCs	Mark Davis
		TC26: Structure & Vibrations	Bernard Hehlen
		TC27: Atomistic Simulation	Jincheng Du
Characterisation	Mathieu Hubert	TC02: Durability & Analysis	Peggy Georges
		TC06: Mechanical & Nanomechanical Properties	Lothar Wondraczek
		TC10: Optical Properties	Ingrid Marenne
		TC19: Surface Properties	Seong H. Kim
		TC04: Bioglasses	Delia Brauer
		TC05: Waste Vitrification	Ashutosh Goel
		TC12: Pharma Packaging	Massimo Guglielmi
		TC16: Nanostructured glass and coating by wet chemistry	Alex Martucci
		TC20: Photonic glasses and optical fibers	Gian Carlo Righini
		TC28: Glass fibres for reinforcement and insulation	Yuanzheng Yue
Glass Production	Hande Sesigur	TC09: Energy Efficiency	Hans Van Limpt
		TC11: Materials for Furnaces	Rongxing Bei
		TC13: Environment	Walter Battaglia
		TC14: Gases in Glass	Mustafa Oran
		TC18: Glass Melting	Jaroslav Klouzek
Communications, Education, History		TC21: Furnace Design & Operation	Aaron Huber
		TC01. Communications	John Parker
		TC17: Archaeometry	Stephen Koob
		TC23: Education	Ana Candida Rodrigues
		Youth Outreach Committee	Mathieu Hubert

1.10 Plans for 2020

Prior to the outbreak of COVID-19 the Annual meeting on ICG was planned to be held in Krakow, Poland on 20 - 24th September 2020. This was planned to include technical committees meetings and a CTC Business Meeting.

Unfortunately the 12th ICG Montpellier Summer School was cancelled by the COVID-19 crisis. 6th ICG Winter School will be held in Wuhan, China, from 1 - 7th, November, 2020.

2 Summary of R&D Activity Fields & TC Activities

2.1 BASIC GLASS SCIENCE – Coordinator: B Hehlen

TC07 chair M. Davis has apologized for not having sent his TC report. The reasons are medical. He is currently searching for a new chair. Reminders have been sent to TC03 but still, the annual report is missing. The cluster report below therefore summarizes the activity of TC26 and TC27, and common TC03-TC26 actions as well.

TC meetings at conferences

TC03, TC07, TC26, and TC27 held TC meetings during ICG Congress in Boston in June 2019.

Organization of conferences and session-chair at conferences

TC07 members the session on Crystallisation of Glasses and Glass Ceramics at ICG Congress 2010 in Boston. (June 2019)

TC27 members organized and chaired the Modeling and simulation sessions at ICG Congress 2019 in Boston. (June 2019).

TC27 Chair co-organized and co-chaired the Glass and Optical Materials Symposium during MS&T 2019 in Pittsburg OR. (Oct. 2019).

TC27's proposal to organize the 4th Challenge workshop of MD simulations of glass and amorphous materials was funded.

TC26&TC03 organized and chaired two joined sessions at ICG Congress 2019 in Boston (jun 2019):

Structure of glass : Network Formers and Network Modifiers

Glass and Melt: Macroscopic Properties and Structure of Melt at High Temperature

ICG-Prizes

TC27 webpage on ICG website was selected as the best website of 2018 by ICG CTC.

TC27 Chair Prof. Jincheng Du was awarded the W.E.S. Turner Award of ICG.

Other activities

TC27 Chair contributed a book chapter on “*Molecular Dynamics Simulations of Oxide Glasses*” for the *Handbook of Glasses* published by Springer.

TC26 Database on Raman spectra “ICG database”: the platform is now open for internal tests, thanks to R. Down at the Arizona Univ., B. Lafuente at the SETI Institute (California), and their developer's team. Address <https://odr.io/ICGlassVib>

TC27 and TC26 added new TC members and retired few non-active members from their TC.

Summary 2019

4 TC meetings, 5 sessions at conferences, 1 publication, 2 ICG-prizes, 1 long-term action pursuing (Raman database). In- and out-going TC members in TC27 and TC26.

2.2 GLASS PRODUCTION – Coordinator: Hande Sesigur

There are six technical committees (TC) in the Glass Production cluster. All these committees continued their activities according to the needs of the glass industry with the coordination of “Coordinating Technical Committee” of ICG.

TC09

Technical Committee on Energy Efficiency TC09, mainly focus on glass melting since this contributes on average about 60-65 % to the total energy consumption in glass production. The aim of this committee is to identify the major process steps with energy efficiency improvement potentials, to select suitable technologies, to test or develop tools that supports energy efficiency investigations such as energy balance models, protocols for energy management, energy audits and finally to define research activities for developing energy saving glass production methods.

TC09 aimed to define a uniform approach for energy efficiency or specific energy usage within the glass industry. The existing non uniformity is compounded by the fact that there is no common approach in the consideration of factors such as the effect of cullet, the efficiency of electric boosting, furnace age, design etc.

This technical committee had one annual meeting in 2019. The meeting was held during the ICG conference which took place at Boston. At the meeting they passed through the minutes of Yokohoma meeting, discussed on the ICG 2030 project and other technical studies.

TC09 started to develop recommended Best Practices for defining energy use and efficiency so that manufacturers last year. The results of this project will be used to explain the energy balances of glass furnaces and to evaluate the methodology of applied energy balance models, measuring techniques and benchmark data. In this connection 6 float furnaces investigated with the aim to define a uniform approach to define energy efficiency or specific energy use within or across the various glass industry sectors. They discussed on the results they obtained and a draft publication is in progress.

Last year TC09 also started a round robin comparison of calculating the Thermodynamic Energy Requirement for glass melting for some selected glasses. There is not a clear standard for what is the actual minimum amount of enthalpy (thermodynamic energy requirement) that is needed to melt a certain soda lime (Container) glass batch. Several batches were defined and the minimum melting energy was calculated by using thermodynamic models last year. Based on the results that they obtained in 2019, the differences between both models are of the order of magnitude of 5 to 10 %. In order to exchange information, a dropbox folder has been opened on which past and new information were uploaded to be shared with all active participants. TC09 exchanged information on running projects and new initiatives to reduce energy consumption in the glass production process.

A poster explaining the activities of this TC were prepared for the ICG Conference at Boston. Finally they plan to meet at ICG Annual meeting which will be held in Krakow, Poland in Sept,2020. They will try to finish the publication on energy benchmark project. ICG has awarded a budget in 2019, Hans Mahrenholtz from GS will work on it.

TC11

Technical committee working on refractory materials and its interaction with the glass melt, TC11, aims to discuss the material related problems in glass melting furnaces and the defects generated by these materials like blisters, stones, knots and cords. TC11 tries to find out solutions and experimental testing methods by exchanging the knowledge and experiences between the members and participants from refractory industry, glass industry and academia.

TC11 worked on the evaluation of silica testing methods. They collected different methods and will try to prepare a document in "recommendation for corrosion of silica bricks". Technical committee also worked on a silica round robin test program. A RRT study was planned in order to investigate the performance of silica refractories. All TC11 members attended this round robin test. Committee will evaluate the results next year. Another topic discussed during the meeting was refractory mixes.

TC11 plan to carry out a study on investigation of blister forming factors such as impurities, oxidation stage of the fused cast materials etc. A recommendation for blistering test planned to be prepared. another study will be on the evaluation of new test methods for refractory materials. Committee plan to meet at October 19th, 2020 in Düsseldorf during the fair.

TC13

The mission of TC13 is to achieve best practice by exchange of information concerning current and developing techniques for reducing the environmental impact of glass during its production, use and disposal. This shall include the comparison of the results of different control techniques and the determination of best practice for measuring pollutants (primarily total particulate, NO_x, SO_x, HCl, HF & heavy metals) by means of parallel measurements, material balances, and round robin tests.

Since the emission limits becomes tighter and more expansive there is a critical need for better and more reliable measurement methods. TC13 will help provide the glass industry with adapted and affordable standard protocols, and it will help the industry benefit from new monitoring and emission control technologies.

TC13 had its first 2019 meeting which was hosted by AGC at Louvain-La-Neuve, Belgium. The meeting had a full agenda with thirteen participants (including one invited guest) and they discussed many important environmental and health issues associated with the manufacture of different types of glass. The committee discussed on expanding the committee membership to include more representatives from container glass, management of the website and Project ICG 2030.

SO_x emissions and the difficulty meeting the BREF limits with current abatement technologies was then discussed, which led to a later presentation on the Sorb Saver system from America which can help improve absorption efficiency. It was confirmed that the TC13 work on respirable crystalline silica in sand had been published in the Glass Worldwide, January/February 2019 edition. The committee then reviewed the REACH dossier for glass and decided that it should be updated to include new information.

The committee then covered the topic of furnace emissions, which included discussion on methods for SO₃ measurement and a comprehensive presentation on comparative tests, which demonstrate the suitability of FTIR for measurement of HCl, SO₂, NO_x and NH₃. There was discussion on PCB measurements and how results close to and less than the blank value should be reported. Results of emissions measurements of boron and mercury from container glass were also presented. These highlighted a potential issue in Germany where new draft limits have been proposed.

The second meeting of 2019 was hosted by Saint Gobain at their German and Eastern Europe headquarters in Aachen, Germany. The committee discussed the improvements to the TC13 websites hosted by ICG and Celsian and the proposal to make 2022 the United Nations International Year of Glass for 2022. The factors affecting the removal efficiency were discussed as well as the recycling of the boron filter dust into the furnace.

The group then considered the revision of the TC13 leaching method which is used to determine whether a glass substance requires registering under REACH. The group agreed to revise the paper as long as further information becomes available on limits for boron leaching and examples of where the method has been used.

The committee then addressed emissions from glass furnaces. This included discussion on the formation of condensable particulate after a ceramic catalytic filter, a presentation on the Sorb Saver system and a summary of NO_x emissions limits in the Italian glass industry. There was also a comprehensive presentation on measurement of dioxins and PCBs and discussion on quality control requirements and treatment of the blank values. The meeting concluded with a round table on regulations and new abatement plants.

TC13 planned to have two meetings for 2020. The rolling assessment of environmental issues addressed at each meeting will continue. This will include discussions on the recycling of flue gas filter dust, the REACH leaching method, emissions measurement techniques, conversion of SO₂ to SO₃ in SCRs, measurement of dioxins and PCBs and the performance of new abatement systems. The committee plans to publish a paper discussing the calculation of flue gas volume flow and may also publish an update to its paper on the TC13 REACH leaching method.

TC14

Technical Committee working on gasses in glass TC14, promotes activities to better understand evolution mechanisms of gases in glass and bubble formations. It supports cooperation with other Technical Committees in order to fulfill its mission. Most of its recent activities have been carried out jointly with TC11 and TC18 regarding the influences of glass contact materials and melting process on bubble formation.

The agenda of TC 14 has already a list of tasks including previous works and the new proposals but TC 14 not been able to hold large-scale meetings in recent years, except review meetings with a very few members. Therefore, they decided to organize a meeting conjunction with an international event of 2020.

They considered that some previous topics can be still extended and/or repeated with the new approaches/methods. Interrupted dynamic bubble-refractory test or determination of rate of change of bubble size during fining/refining will be the first topic to be evaluated. Bubble analysis with other methods than MS (Raman Spectroscopy, know-how restrictions but maybe only on its basic physics) will also be discovered with round robin tests. Numerical model of bubble behavior will be the third topic and they plan to find a numerical relation between rate of change of bubble size with respect to temperature and glass composition.

TC18

The committee on Glass Melting” promotes both fundamental and applied research on phenomena connected to glass melting processes. It supports co-operation among technical committees involved in the cluster Glass Production.

TC18 met during 25th International Congress on Glass in Boston on June 9, 2019. The committee took part in the organization of the “Glass Technology and Manufacturing Session / Raw Materials, Batch Melting, and Fining” of the 25th International Congress in Boston.

Their main activity was on batch melting kinetics. Batch to glass conversion is a limiting factor for the entire glass melting process as well as for the efficiency of nuclear waste vitrification. The aim of this project is to review current state-of-the-art approaches to glass melting modeling and to evaluate possible paths to simple but powerful physicochemical models based on physicochemical principles

TC 18 plan to meet during the 15-th ESG conference and ICG Annual meeting 2020 in Krakow, September 20, 2020. The committee plan to organize a session entitled “Glass melting” at 15-th ESG conference.

TC21

The main activity of TC21, Technical Committee on Glass Furnace Design and Operation, is to improve the quality and reliability of glass furnace simulation modeling and optimization of software packages of different suppliers and glass producing factories that describe heat transfer, flows and temperatures in glass furnaces (melt, batch & combustion space).

The most effective way to understand the strong and weak points is by simulating with the different participants the same well defined existing glass melting furnace and ideally with actual measured and validated data. This allows the different participants to compare and validate results with each other and also with real measured data.

In 2019 TC 21 held meetings at both the International Seminar on Glass Furnace Design and Operation in Velke Karlovice Czech Republic and the ICG Congress in Boston, USA. TC21 also sponsored a session at the ICG Congress that had over 250 attendees for the presentations. TC21 conducted Phase I of a round robin test for modeling a small cold top electric glass melter with C-glass. The geometry description and necessary data to develop a full 3D CFD model was compiled and distributed to the TC21 members. Results from several members were presented at the 2019 meetings and issues and modifications identified. Summary of results and revisions to the modeling setup will be focus in 2020.

TC21 will plan to have a meeting at 20 September 2020 at the ICG Annual Meeting held in Krakow, Poland.

2.3 CHARACTERISATION – Coordinator: Mathieu Hubert

This cluster comprises 4 TCS: TC02 (Durability and Analysis), TC06 (Mechanical and nanomechanical properties), TC10 (Optical measurement techniques), and TC19 (Surfaces – reactivated in 2017). The activities of these TCs during the year 2019 were:

TC02 – Durability and Analysis.

This committee focuses on chemical durability testing and analysis and is committed to the pursuit of analytical excellence through the standardization and harmonization of analytical methodology throughout glass and associated industries.

Peggy Georges (Corning) became the new Chair of TC02, replacing Ralf Eiden (Schott).

TC02 activities included:

- Two TC meetings

- April 2019 in Brussels, Belgium
- November 2019 – teleconference
- Conducted an inventory of standards and methods relative to chemical durability and identified outdated standards and/or methods, to establish a list of proposed work items for future activities
- Participation in certification of CRM (Certified Reference Materials)
 - BAM-S053 (hydrolytic resistance of borosilicate glass - ISO 720, USO<660>, Ph. Eur.3.2.1) in 2018, CRM available in 2019
 - BAM-S0005c for traces in SLS glasses, CRM available soon
- Participated in several Proficiency tests, Round Robins, and Validation tests
 - Heavy metals in Container glass (Pb, Cd, Cr6+)
 - Arsenic determination
 - Filter dust analyses
- Plan to continue working on proficiency tests, method development and certification work in 2020

TC06 – Mechanical and nanomechanical properties

TC06 covers the mechanical, including nanomechanical, properties of glasses. The work of the committee involves both test methods (e.g. edge strength measurement) and understanding the fundamentals of glass fracture and the growth of cracks.

The activities of the TC06 in 2019 included:

- TC meeting during the 2019 ICG Congress/GOMD in Boston
- Organization of a technical session on “Strength, Fracture, and the Mechanical Properties of Glasses” at the 2019 ICG Congress/GOMD held in Boston
- Organization of the 2019 International Workshop on Glass & Entropy (Sept. 08-12, 2019, in Jena, Germany). gathering over 100 participants from > 20 countries.

TC10 - Optical measurement techniques.

This TC focuses on the different optical measurements of glass and coated glass, as well as on their basic optical properties. This TC connects and engages industrial companies, research institutes, and academics.

TC10 activities included:

- Two TC meetings
 - April 2019 Venice, Italy (at Stazione Sperimentale Del Vetro)
 - October 2019, Wurzburg, Germany (at Fraunhofer Institute fur silicatforschung ISC)
- Work on diffuser samples
 - Demonstrated the use of diffuser for calibration and measurement using standard spectrophotometer, using a correction method after measurement, for diffusing glasses
 - Established proposed rules for selection of diffusers as function of the type of glass studied – expected to be published by the TC
 - Work in close collaboration with NFRC and LBNL committees – working on new standard to characterize diffusing samples. TC10 members will be engaged in this effort
- Participated in norms and standardization work
 - CEN129 WG9 norm round robin tests to validation of simulation tools for optical properties
 - Interactions with EN140 and ISO9050 groups
 - Recommendations on ISO23237 (glass in building – light transmission for photovoltaic glass)
- Round Robin tests
 - Low iron glass RR completed
 - Plan for RR test for tensile stress in float in 2020

TC19 – Surfaces

The overall objectives this TC are to establish a forum to present, discuss and disseminate new findings on fundamental surface science of glass materials

TC19 activities included:

- TC meeting during the 2019 ICG Congress/GOMD in Boston
- 2 new members added to the TC
- Discussion of the key technical challenges in glass surface science (as how to measure dissolution/corrosion rates, surface charge, surface adsorption / reaction sites, adsorption of water, and so on.)
- Plan to participate in the organization of a session on glass durability at the 2020 GOMD Conference in New Orleans (USA)

2.4 APPLICATIONS – Coordinator: Julian Jones

TCo4: Bioglasses

Chair Delia S. Brauer

TCo4 aims to promote global visibility of biomedical glasses and stimulate collaborations between academics and industry. Examples are outreach projects (public and end user engagement); input into international standards; liaising with professional bodies; conference organization; scientific publications and road mapping. We have a YouTube Channel and a scientific journal BIOMEDICAL GLASSES.

2019 activities highlights

Publications

- A Special Issue "[50 Years of Bioactive Glasses](#)" has been Open Access published in [Biomedical Glasses](#) (editor-in-chief: Aldo Boccaccini; TCo4 members Julian Jones, Delia Brauer and Chengtie Wu)
- Amy Nommeots-Nomm, Delia Brauer, Leena Hupa and Dana Rohanová published a [review paper on acellular immersion studies](#) on bioactive glasses, published in a Special Issue "Women in Glass" in the International Journal of Applied Glass Science.
- 3rd edition of TCo4 member Wolfram Höland's well-known text book on [Glass-Ceramic Technology](#) has been published by Wiley.
- Julian Jones wrote an article on Glass for Regenerative Medicine, in the April 2019 issue of [Glass International](#).

Awards

- Robert Hill was the 2020 recipient of the [Varshneya Glass Technology Lecture](#), awarded by the ACerS Glass & Optical Materials Division (at ICG2019).

Interfacing with ACerS

- Julian Jones is Chair-elect of the [Bioceramics Division](#) of the American Ceramics Society. TCo4 and the Bioceramics Division work together on organising sessions at the MS&T annual meeting and the ICG Congress 2019.

Conferences

- TCo4 celebrated the receiving of “best website” award from the ICG’s CTC at the ICG2019 meeting in Boston, at which Delia Brauer, Qiang Fu and Julian Jones organised the Glasses in Healthcare session at the [ICG Congress 2019](#) in Boston. Dave Greenspan and Amy Nommeots-Nomm were invited speakers.



- Aldo Boccaccini and Delia Brauer organised a Special Session at [European Society for Biomaterials](#) (ESB2019), Dresden, Germany. Julian Jones was keynote speaker.
- A Special Symposium was held in honour of Prof. Delbert E. Day at the 2019 ACerS [GFMAT-2/Bio-4 conference](#) held in Toronto, Ontario, Canada. It was organised by Richard Brow and Mohamed Rahaman; Leena Hupa, Delia Brauer, Steve Jung, Qiang Fu, Wolfram Höland and Ifty Ahmed were invited speakers.

2019 Plans

Delia Brauer is co-editing a book on Phosphate and Borate glasses for Medical Applications, with contributions from TCo4 members.

Delia Brauer is programme chair (together with Jessica Rimsza, Sandia National Lab) of the 2020 ACerS [Glass & Optical Materials Division 2020 Annual Meeting](#) held in New Orleans, LA, USA.

Jérémy Soulié has successfully obtained funding for a bilateral exchange project between his group at CIRIMAT, Toulouse, France, and the group of Delia Brauer, Jena, Germany. This exchange will take place in 2020 and will focus on research on pyrophosphate glasses.

- Building on the success of the SBF round robin study and publication, which is available [online](#) and has been cited over 100 times, it is timely for a round robin study on cellular response. The test will include a protocol based on the ISO standard (extracts) and propose a method for cell culture studies on bioactive glasses. It will be led by Julian Jones, Steve Jung and David Greenspan, who is also leading an ASTM working group to define bioactivity. The study planning began at the TCo4 annual meeting at ICG2019.

TCo5 Waste Vitrification

Chairman: Oliver Pinet

The mission of the committee is: 1) a forum to present, discuss and disseminate technical information on waste glass chemistry, vitrification processes, vitrification melter technologies, and waste glass environmental performance; 2) to facilitate the dissemination of technical information through promoting programming at technical conferences, conducting technical workshops and facilitating publication of information through established channels.

2019 Activity highlights

Workshops and Symposia

- "Scientific Basis for Nuclear Waste" at MRS, organized by Michael Ojovan, Vienna.
- "Ceramic materials for nuclear energy" organized by Kevin Fox and Russell Hand at PACRIM13.
- TC05 session at ICG2019, Boston, organized by Olivier Pinet, Ashutosh Goel, and Kai Xu, which included 60 oral presentations.

Educational courses were hosted

- 8 vitrification lectures, organized by Dr. Olivier Pinet, at the 11th ICG Summer School.
- 27 invited lectures for ICTP-IAEA International School on Nuclear Waste Vitrification, organized by Prof. Michael Ojovan.

Publications

- Special issue "Vitrification and geopolymerization of industrial wastes" in Materials Letters was guest edited by J. Ma. Rincon, Aldo R. Boccaccini and Manuel Jordán.

PLANS AND DELIVERABLES FOR 2020

Contributions to the ICG Summer and Winter Schools and to the ICTP-IAEA International School on Radioactive Waste Cementation in Italy (<http://indico.ictp.it/event/9129/>).

TC12 Nanostructures

Chairman: Massimo Guglielmi

Aim is to verify the "weaknesses" of glass containers for pharmaceuticals and to identify the R&D needs in this field, e.g. "delamination" phenomena, adsorption effects and the influence of big molecules. Longer term themes are related to the fragility of glass. The first objective of TC12 is to find a standardised method for the evaluation of the propensity to delamination.

2019 activities

Round Robin

- 8 labs tested TC12 protocol for predicting delamination propensity. "Good" vials provided by industrial TC members were compared with a set of "positive" vials. Seven labs observed flakes only in "positive" vials but two labs observed lamellae in "good" vials, albeit at 1-2 orders of magnitude smaller than "positive" vials.

Conferences

- Open Session at ICG2019 organised Daniele Zuccato, Holger Roehl and Massimo Guglielmi, with other TC members speaking.

2020 plans

- Publication of the round robin results
- New experimental activities on modernization of compendial testing on Glass for Pharma and / or Extractable and Leachables.

TC16 Nanostructured glass and coating by wet chemistry

Chairman: Alex Martucci

TC16 has very much a collaborative research project focus focused around the development of nanostructured functional coatings for solar management.

2019 activities

- Strengthening of collaboration with the with International Sol-gel Society (ISGS) board;
- Focus on collaborative research of doped-glass coatings (e.g. sol-gel) for photovoltaic solar cells and coatings based on ZnO doped with aliovalent cations (for example Ga, Ge, Si, etc.) for solar control;
- CTC-funded collaborative research project "Nanocrystalline sol-gel coatings for solar energy applications", the sol-gel method is used to prepare multi-component films. A. Martucci visited the IST lab (in Lisboa) visited the IST lab (in Lisbon).

2020 Plans

- R. Almeida and A. Martucci will edit a book entitled "Sol-gel derived optical and photonic materials".

TC 20 Optoelectronics

Chairman: Gian Carlo Righini,

Focusing on glasses for photovoltaic applications.

2019 activities (highlights)

- Organised 8th Intl. Workshop on Photoluminescence in Rare Earths, a flag event of TC20, in Nice, France, which included awards sponsored by a CTC grant;
- Gian Carlo Righini produced a video of TC20 activity for ICG2020 youtu.be/G-3jRa1Q6Ws
- A repository TC20 relevant Open Access journal articles has been set up.

2019 Plans

- Special Issue of *Ceramics International* of papers from [PRE'19 Workshop](#). Guest Editors include *Wilfried Blanc* and *Giancarlo C. Righini*.
- Special issue of *Applied Sciences* on the subject of [Ion Exchange in Glasses and Crystals](#). Guest editors are Jesús Liñares Beiras and *Giancarlo C. Righini*.

TC24 Coatings (no update since 2015 due to the Chairman being in ill health)

Chairman: Joop Van Deelen

TC28 Glass fibres for reinforcement and insulation

Chairman: Yuanzheng Yue

2019 Highlights

- Organised a Glass Fiber Symposium at ICG2019.
- Three quarters of the book entitled "Fiberglass Science and Technology: Chemistry, Processing, Characterizations, Applications, and Sustainability" was finalized.

2020 Plans

- Completion of the book "Fiberglass Science and Technology: Chemistry, Processing, Characterizations, Applications, and Sustainability"
- Organisation of 5th International Glass Fibre Symposium, Aachen, Germany
- Contributions to the ICG Winter School.

2.5 INFORMATION, EDUCATION, HISTORY – Coordinator: John Parker

All the TCs in this cluster have been exceptionally busy as a consequence of the ICG Congress in Boston during the year in addition to several new and ongoing successful activities.

A joint activity between TC01 and TC23 has been the production of the book *Teaching Glass Better*. It was made available for pre-order at the Boston Congress and can be purchased through DGG, SGT and the Chinese and Japanese Ceramic Societies. Few copies of the initial print run of 1000 are left and an e-copy is being considered as an alternative to a reprint.

The ICG web site is regularly updated. 18 press releases have been published. Press releases provide a good opportunity to advertise PhD. positions, a facility used extensively. The issue of company logo display as part of any sponsorship agreements needs to be formally considered.

An important activity has been the preparation of advertising matter for distribution at conferences and Trade Fairs e.g. the triennial ICG congress and the Vitrum trade fair in Milan. The ICG Congress organisers working with TC01 displayed TC posters for every committee electronically and produced a few videos advertising individual TCs, both firsts. A0 posters and A5 leaflets advertising TC activities, books and schools were circulated at the Boston Congress and for the Vitrum Trade Fair in Milan in October. The Vice President of ICG, Prof Conradt, represented ICG at the latter event.

During the last year ICG has taken a central role in a submission to the United Nations proposing 2022 as an International Year of Glass. Further information can be found on the web site: www.iyog2022.org. TC01 is responsible for this web site and in preparing printed publicity material.

Many of the actions of TC01 are undertaken regularly and these are expected to continue. There are many ways of developing such activities given sufficient support; plans being formulated under the ICG2030 banner will no doubt impact on the future role of this committee but are currently hindering natural development.

The objectives and activities of TC17 differ somewhat from those of other TCs. It brings together glass scientists, archaeologists, museum curators, and conservators to present and discuss the results of research on early glass and glassmaking, and on the conservation of historical glass objects. TC17 centres its programs on the research and glass problems of the regions where the Congresses are held. It therefore has an important role in an International Year of Glass.

During 2019 TC17 organised two meetings. Dr. Alok Kumar Kanungo ran an international Conference cum Workshop on the History, Science and technology of Ancient India Glass held at the Indian Institute of Technology, Ghandinagar, India. January 21-25, 2019. At the ICG Congress in Boston TC17 arranged a topical session on *Archaeometry* - a specialized forum for research and application of Archaeometry and Archaeological Sciences in glassy materials, covering the full spectrum of topics, techniques, chronologies and regions; it attracted 18 oral presentations and 4 posters. Three major topics were: **Archaeometry, Conservation problems and New techniques of analyses in the context of archaeometry.** Conservation has interesting overlaps with the work of TC04 (biomaterials) and TC05 (waste immobilisation).

TC17 continues to be more active; it reviewed its membership but added no new members in 2019. There is a strong interest in publishing the papers from the XXV ICG Congress and in attending the Annual Conference in Krakow Poland; it will continue to work with the IYOG team.

TC23 organizes courses, workshops, and schools related to glass science and technology, it provides information on such events organized by others, and explores both well-established and new formats of instruction. It has defined a core team who have kept in touch during the year.

Activities of TC23 in 2019 included the 11th Montpellier Summer School, 7-12th July in Montpellier. It attracted representatives from 12 different countries including 6 from Industry. A feature was the high proportion of female attendees. Following the example of the previous winter school in Wuhan, the course had two streams: basic science and waste immobilisation.

The first Photonic School was held in Quebec City, Canada from June 16th to the 21st at the Centre for Optics, Photonics and Lasers (COPL) at Université Laval, in Quebec City, Canada following the ICG Congress and attracted 80 participants from 13 different countries. This international training initiative was co-chaired by Younès Messaddeq from Université Laval, and Kathleen Richardson from the University of Central Florida (UCF).

Significant fund raising was carried out to enable attendance at the School. Tutorial lectures (including aspects of laboratory safety) were taught by 22 international experts from Canada, France, Germany, Japan, Spain and USA, who introduced the participants to cutting edge advancements as well as practical perspectives of the industry. Furthermore, the School provided young research participants with 20+ hours of hands-on practical laboratory experience. The outcome of these projects was reported in 15 min oral presentations in an afternoon session at the end of the School from which, a best project report prize sponsored by Sentinel Nord, was presented to two teams.

The most recent ICG school took place between 20th and 25th October 2019 at what has become our traditional venue of the Wuhan University of Technology, China. This year the school concentrated on the theme of Glass Science, attracting 26 students. While fewer than previously because there was no parallel theme there was no shortage of quality among those that gathered at the International Vienna Hotel near the University. Seven Chinese Institutes and Universities were represented among the student group, more than previously. Four students had travelled from Europe (Denmark, Germany and UK); each received generous scholarships providing travel and accommodation support from China Triumph International. The company was represented throughout the event by Mrs K Wang, assistant to the director as well as Executive Secretary of ICG; she also provided valuable assistance in judging the project competition at the end of course. A question and answer session on the

penultimate day using questions submitted during the week also created a lively debate and gave all the lecturers the opportunities to link their lectures to the students' research studies. At next year's school small group tutorials will also be offered.

In 2019, the Youth outreach committee teamed up with ACerS PCSA for organizing an "Early Career Networking Event" at the 25th ICG Congress/GOMD meeting in Boston. For 2020, the team plans to support the organization of outreach event at the ESG-ICG conference in Krakow, Poland".

As part of TC23 activities the CeRTEV, Center for Research, Technology, and Education in Vitreous Materials, founded by Fapesp, Brazil, has organized a Glass Technology Course, for glass industry personnel and engineers. However, as a strategic decision, the third CeRTEV Course in Glass Technology planned for August 2019 was postponed to the end of March 2020. The course "Techniques in Glass Production", a project in partnership with the Paula Souza Center, Abividro and the glass company Nadir Figueiredo, started with its first cohort in February 2018 and was very popular.

CeRTEV has also offered training sessions to teachers of the Paula Souza Center as described in the 2018 TC23 annual report. In 2019, these training sessions continued, and new topics were covered:

- a) Glass Furnaces in the Glass Industry, 20h, 4 remotely - Apr 2019, at Paula Souza Center,
- b) Refractory Manufacturing, 20h, 4 remotely - May 2019, at LaMaV, Federal Uni. of São Carlos
- c) Manufacturing and transformation processes of the Glass Industry, July 2019, taught through two technical visits, the first to AGC float glass, Guaratinguetá, the second to "Glassvale" transformation glass industry in São José dos Campos

Four comics in Japanese "Manga" style were translated into English. In the next TC23 meeting, we will discuss the printing, distribution, and availability of these Mangas to the general public.

Some recommendations for the organization of successful ICG schools were proposed in 2016, and are listed again here, to stress their importance. A successful school should address four core topics, beside an annual focus on selected special topics. The new generation of glass scientists needs a solid foundation in:











- fundamentals of the glassy state,
- structure of glass
- thermodynamics of glass,
- transport properties, comprising both materials science (diffusion, conductivity, and crystallization) and engineering (heat and mass transfer).

Instructors should not offer "conference type" talks illustrating their latest scientific achievements. Rather, the lectures should provide good summaries of what students need to know.

If possible, they should be kept in the geographical area where they started. Students activities (projects) and student-teacher interaction are major ingredients of a successful school. Planting new schools in new geographical areas is not a focus of the TC23. Such initiatives should, however, be supported by providing advice. There is a need to define the conditions for a school to run under the ICG label.

Two ICG schools are planned for 2020 in Montpellier and Wuhan. A third is being considered for India in 2021. A third CeRTEV Glass-Technology course is also being arranged in São Carlos, Brazil, from March 30th to April 4th, 2020.

TC17 Archaeometry	S Koob	
TC18 Glass melting	R Beerkens J Klouzek	
TC19 Coatings on Glass	V Rupertus	
TC19 Glass Surfaces	S H. Kim	
TC20 Optoelectronics	S Tanabe G Righini	
TC21 Modelling Melting	E Muijsenberg A Huber	
TC22 Structure/ Properties	G Calas	
TC23 Education	R Conradt A Rodrigues	
TC24 Coatings o n Glass	K Sanderson J Van Deelen	
TC25 Modelling Forming	C Berndhauser A Karadag	
TC26 Structure & Vibrations	B Hehlen	
TC27 Atomistic Simulation	J Mauro J Du	
TC28 Fibre Reinforcement	Y.Yue	
Youth Outreach Committee	M Hubert	

TC17 Archaeometry	S Koob	
TC18 Glass melting	R Beerkens J Klouzek	
TC19 Glass Surfaces	S H. Kim	
TC20 Optoelectronics	S Tanabe G Righini	
TC21 Modelling Melting	E Muijsenberg A Huber	
TC23 Education	R Conradt A Rodrigues	
TC24 Coatings o n Glass	K Sanderson J Van Deelen	
TC26 Structure & Vibrations	B Hehlen	
TC27 Atomistic Simulation	J Mauro J Du	
TC28 Fibre Reinforcement	Y.Yue	
Youth Outreach Committee	M Hubert	

Decisions on the following persons/functions were taken:

The name of TC20 is approved as "Photonic glasses and optical fibers".

New chair of TC02 of Peggy Georges was approved and the vice-chair was Ralf Eiden.

New chair of TC05 of Dr. Ashutosh Goel was approved and both Dr. Kai Xu and Charmayne Lonergan became vice chairs.

New chair of TC07 of Mark Davis was approved.

New chair of TC13 of Walter Battaglia was approved.

4. Reports of the activities of individual TCs

In 2019 TC chairs have also been asked to submit their reports directly to the ICG web site so that they are more accessible to the wider public and also available in a more timely fashion. Thanks to the efforts of the TC chairs this process has been continue and the reader is therefore referred to:
www.icglass.org