

**A: ICG Advanced Course
“Strength of Glass – Basics and Test Procedures”
June 19/20, 2006**

**B: DGG Hands-On Course
“Fractography of Glass – Causes of Damage
especially in Automotive Glazing”
June 20/21, 2006**

**Department of Materials Science and Engineering
Friedrich-Alexander-University Erlangen-Nürnberg
Erlangen (Germany)**

Many applications of glass are predominantly determined by its strength behaviour which depends on the geometry, the stress state and the surface nature of the glass product, but also on the type and duration of the loading.

Glass possesses a high Young's modulus, which is comparable with that of metals and thus enables the fabrication of products with high rigidity – in contrast to polycarbonate with a much lower Young's modulus. However, glass - as a brittle-elastic material – is susceptible to fracture and due to its chemical reactivity also to static fatigue.

It is the goal of the ICG Advanced Course to secure the most essential basics of stress formation, crack propagation and statistical evaluation of fracture events and, furthermore, to introduce the relevant methods of stress and strength measurements as well as the fractographic characterisation of fracture surfaces as a means to elucidate failure causes.

The Advanced Course addresses employees of the glass industry in the fields of production, processing, application and testing as well as all engineers and scientists who are not experts in this particular topic but look for a sound introduction.

The lecturers of the Advanced Course have long-standing practical experience of solving problems and offering solutions in the field of glass strength and thus fulfil the requirements for an updated and practice-oriented knowledge transfer.

Following the ICG Advanced Course from June 20 (afternoon) until June 21 (noon) 2006, a Hands-On Course (with specimens and microscope practise) is offered on Fractography of Glass by Prof. Dr. J. Varner, New York State College of Ceramics, Alfred, NY, also at the Department of Materials Science and Engineering in Erlangen.

For further information: www.hvg-dgg.de

A: ICG Advanced Course

“Strength of Glass – Basics and Test Procedures”

June 19, 2006

8.30 **Welcome Address**

8.40 **Dr. R. J. Hand**

Department of Engineering Materials
The University of Sheffield, Sheffield (United Kingdom)

Stresses and Stress Measurements in Glasses

- Introduction to stresses in glass
- Permanent stresses and temporary stresses (thermal stresses, annealing and tempering)
- Stresses in glasses arising from external loading (contact, pressure)
- Measurement of stresses (photoelasticity, scattered laser light)

10.55 **Coffee Break**

11.15 **Prof. Dr. J. R. Varner**

New York State College of Ceramics
Alfred University, Alfred, NY (USA)

Strength and Fracture Mechanics of Glass

- Theoretical strength
- Practical strength (Griffith equation, methods of measurement)
- Fracture toughness (energy release rate, stress-intensity factor)
- Relationship between strength and fracture mechanics (static fatigue, slow crack growth)

12.30 **Lunch Break**

13.45 **Continued by Prof. Dr. J. R. Varner**

15.00 **Coffee Break**

15.20 **Dr. K. Nattermann**

Schott AG, Mainz (Germany)

Fracture Statistics

- Statistical evaluation of strength measurements (choice of distribution function, analysis of outliers)
- Interpretation of fracture statistics (extrapolation to small loads or large areas, reliability evaluations, lifetime predictions)
- Fracture statistical evaluation of finite element calculations (problems and limitations, examples)

17.35 **Discussion**

A: ICG Advanced Course

“Strength of Glass – Basics and Test Procedures”

June 20, 2006

8.30 Dr. H. Müller-Simon

Research Association of the German Glass Industry (HVG)
Offenbach (Germany)

Strength of Container Glass

- Measuring techniques for strength testing
(bursting pressure test, pendulum impact test)
- Causes of strength degradation
(glass defects, handling)
- Influence of shape, calculation of stresses
- Measures for increase of strength
(treatments, coatings)

10.05 Coffee Break

10.25 Prof. Dr. J. R. Varner

New York State College of Ceramics
Alfred University, Alfred, NY (USA)

Fractography

- Normal stress law
- Fracture marks
(origin, mirror, Wallner lines)
- Quantitative fractography
(fracture mirror constant, correlation between
crack size and fracture toughness)

13.00 End of Course

B: DGG Hands-On Course

“Fractography of Glass – Causes of Damage especially in Automotive Glazing”

June 20, 2006

14.15 **Dipl.-Ing. G. Teicher**
Rüsselsheim (Germany)
Welcome Address

14.25 **Dipl.-Ing. G. Bauer**
Adam Opel AG, Rüsselsheim (Germany)
Automotive Glazing – Fractures and Cracks in Practice

15.10 **Prof. Dr. J. R. Varner**
New York State College of Ceramics
Alfred University, Alfred, NY (USA)
Introduction into the Stereoscopic Investigation of Fractured Surfaces

15.55 Coffee Break

16.15 **Prof. Dr. J. R. Varner**
New York State College of Ceramics
Alfred University, Alfred, NY (USA)
**Automotive Glazing – Fractures, Cracks, Crack Structures
What do they tell the Expert?**

17.30 **Discussion**

June 21, 2006

8.30 **Hands-On Course**
Training on the Stereomicroscope

10.50 **Coffee Break**

11.10 **Hands-On Course continued**

14.00 **End of Course**

Venue

Both courses, (A) ICG Advanced Course "Strength of Glass – Basics and Test Procedures", and (B) DGG Hands-On Course "Fractography of Glass" – with Training respecting Causes of Damage especially in Automotive Glazing take place at the

**Department of Materials Science and Engineering
Friedrich-Alexander-University Erlangen-Nürnberg
Martensstr. 5
91058 Erlangen (Germany)
phone +49 (0) 9131 8527544**

The Department of Materials Science and Engineering is part of the Technical Faculty of the University which is located at the Southern rim of the City of Erlangen.

The site can be reached from the Airport of Nürnberg, via railway (DB) or via car (Autobahn BAB 3, exit "Tennenlohe"). For further information: www.techfak.uni-erlangen.de

Accommodations

Hotel room reservations can be placed via Tourist-Information Erlangen, Rathausplatz 3, 91052 Erlangen (Germany), phone +49 (0) 9131 89510, fax +49 (0) 9131 895151, tourist@etm-er.de, www.erlangen.de.

Registration Fees

A: 250.-- € for participants of ICG member countries
350.-- € for participants of non-ICG member countries
The fee includes the course manuscript.

B: 250.-- € for participants of Hands-On Course (limited number of participants)

Registration of Participants

The registration is to be sent **by May 19, 2006** to

Dr. Ulrich Roger Fax +49 (0) 69 97586198
Deutsche Glastechnische Gesellschaft e. V. E-mail icg@hvg-dgg.de
Siemensstr. 45 Internet www.hvg-dgg.de
63071 Offenbach (Germany)

You can register by mail, fax, e-mail or via the internet.

The fees for the registration are payable free of bank commission to:

Deutsche Glastechnische Gesellschaft Offenbach, Postbank Frankfurt am Main, BIC (Swift-Code) PBNKDEFF, IBAN DE05 5001 0060 0055 6066 02, Code "ICG Advanced Course" and/or "DGG Hands-On Course". Please include participant's name and exact address on all money transfers.

The registration fees can also be paid by the following credit cards: AMERICAN EXPRESS, VISA. In this case, please, inform us via fax of the company, number and expiry date of your credit card.

Deutsche Glastechnische
Gesellschaft e. V.
Siemensstr. 45
63071 Offenbach / Germany

Deadline for registration
May 19, 2006

Fax +49 (0) 69 97586198
E-mail icg@hvg-dgg.de
Internet www.hvg-dgg.de

- | | |
|---|-------------------------|
| A: ICG Advanced Course
Strength of Glass – Basics and Test Procedures | June 19/20, 2006 |
| B: DGG Hands-On Course
Fractography of Glass – Causes of Damage
especially in Automotive Glazing | June 20/21, 2006 |

**in Erlangen (Germany), Department of Materials Science and Engineering,
Friedrich-Alexander-University Erlangen-Nürnberg, Martensstr. 5, 91058 Erlangen**

REGISTRATION **A** **B** **A + B**

Name: _____
Surname First name(s) Title

Address: _____
Company, Institution etc.

Street, PO box

Post code, City Country

Phone, Fax E-mail

PAYMENT

A: 250.--€ for participants of ICG member countries, 350.--€ for participants of non-ICG member countries.
B: 250.-- €; additional fee for Hands-On Course; limited number of participants. Payment should be made not later than **May 19, 2006** in EUR (Euro) and free of bank commission by transferring to:
Deutsche Glastechnische Gesellschaft, Offenbach, Postbank Frankfurt am Main, BIC (Swift-Code) PBNKDEFF, IBAN DE05 5001 0060 0055 6066 02, Code "ICG Advanced Course" and/or "DGG Hands-On Course". **Please include participant's name and address on all money transfers.** Payment by foreign cheques: The cheque has to be drawn on a German subsidiary of a foreign bank and has to be issued in EUR, otherwise 15.-- € bank commission has to be added.

The registration fee will be paid by:

my transfer order my credit card as follows: AMERICAN EXPRESS VISA

Card no.:

--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

Expiry date:

Date: Signature: