WORKSHOP
GLASS AND COATINGS

SUMMARY

Welcome to the ICCG workshop during GPD2019 !
This ICCG workshop will be specially organized based on the collaboration of GPD and ICCG (International Conference on Coatings on Glass and Plastics), aiming to provide the information about various ICCG activities and a part of the advanced markets, applications and technologies of coatings on glass and plastics by several selected presentations to the GPD participants.
Through this workshop, the participants will learn about not only some aspects of ICCG activities but also recent architectural and automotive markets and applications in the world, an overview of the most advanced vacuum coating technologies for large area applications, an advanced on-line electrical resistance measurement method for production line, and various new applications and metrologies of coatings based on nano-technology.
Please do not miss this opportunity!

TIMETABLE 26TH OF JUNE

9.00 Opening & Introduction of ICCG
Prof. Guenter Bräuer, Chairman of ICCG and Dr. Koichi Suzuki, Secretary of ICCG

Market and Applications

9.25 Prof. Dr. Şener Oktik, Director, ŞİŞECAM Science & Technology Center
"Multifunctional Coatings on Glass for Construction and Automotive Industries"
10.00 Mr. Stefan Goebel, General Manager, Arnold Glas Corp. , USA
"Design coatings - a game with colours and performances"
10.35 Coffee break

Coating Technologies

10.55 G. Bräuer, R. Bandorf, A. Pflug, V. Sittinger, B. Szyszka, M. Vergöhl
"Some recent developments in sputter technology"
11.30 Dr. Koichi Suzuki, Secretary of ICCG/President of SurFtech Transnational Co.,Ltd./Japanese Representative of FraunhoferFEP, Japan
"High rate PECVD technologies for coatings on large area glass and plastics"
12.05 Lunch

Evaluation Technologies

13.00 Mr. Marcus Klein, Managing Director of Suragus GmbH, Germany
"Perspectives for inline metrology introduction – System selection and dimensioning strategies"

Future application and technologies

13.35 Dr. Johana Kuncova-Kallio, CEO of BioNavis Ltd, Finland
"From micro to nanolayers – and how to characterize them"
14.10 Prof. Bernd Szyszka
"Latest developments in thin film solar cells: challenges in research"
14.45 Invitation to ICCG13 and closing
Prof. Guenter Braeuer, Chairman of ICCG & Dr. Koichi Suzuki, Secretary of ICCG

Duration: 6 hours

GLASS PERFORMANCE DAYS 2019
JUNE 26–28, TAMPERE FINLAND

PRESENTERS

DR. KOICHI SUZUKI
Secretary of ICCG, Japanese Representative of Fraunhofer FEP & President of SurFtech Transnational Co.,Ltd., Japan

PROF. DR. GUENTER BRAUER
ICCG Chairman & Director of Fraunhofer IST, Germany

PROF. DR. SENER OKTIK
Chief Research & Technological Development Officer, SISECAM

STEFAN GOEBEL
General Manager, Arnold Glas, Corp

MARCUS KLEIN
Dipl.-Wi.-Ing. Marcus Klein is managing director of the SURAGUS GmbH

DR. JOHANA KUNCOVA-KALLIO
CEO of BioNavis Ltd, Finland

PROF. BERND SZYSZKA
Professor, Technische Universität Berlin

ABSTRACTS ACCORDING TO PROGRAM

Multifunctional Coatings on Glass for Construction and Automotive Industries

The global flat glass market in 2017 is estimated to be around ~82 billion $ and it is projected to reach ~112billion $ in 2022 (~6% CAGR). Currently more than 60% of the global annual flat production capacity is located in the Asia Pacific region in spite of more than 50 float lines closure in recent years in China. The globally intensifying research and technological development activities on glass surfaces and coating technologies on glass are enabling continuous improvement of the optical, mechanical, electrical and chemical properties of bulk glass and glass surfaces together with functions provided by coating passive and active smart layers on glass. Challenges for coatings on glass sectors are; (i) fragmented market (ii) sectoral trends in applications. The 2016 annual production capacity for coated flat glass is estimated to be over 20 million tons with a market value of ~6 billion$. The market can be roughly divided as; the construction sector; 93%, the automotive sector; ~4%, the solar and other sectors: ~3%. It is anticipated that the CAGR of capacity and market would be ~6,1% and ~%5,9 respectively surpassing 25 million tons and a 35 billion $ by 2022. The current most common manufacturing technologies for coated glass are magnetron sputtering and vapor deposition technologies (~60%) followed by pyrolytic coating technologies (~35%), sol-gel based technologies (~3) and others (~2%).

Soft or hard-coating for low-e and solar low-e layers are the most popular products in architectural and white goods applications. In recent years, technologies to deposit multiple thin film layers on glass for fabricating active or passive systems have been maturing. The products to change the light and heat transmission/emission properties by varying applied voltage, light or heat intensity (smart glass applications) are now available for large volume manufacturing. Increasing efficiency and reliability together with decreasing costs of these new functionalities, have been enabling new and innovative applications for multifunctional coatings on glass in construction and transportation sectors. The global market for smart coatings on glass is predicted to be around ~4 billion $ in 2018 and expected to grow by CAGR of ~20% to over 8 billion $ by 2022.

This brief review is aimed to summarize the worldwide distribution of market for coated flat glass categorized by production technologies, products, applications and industries. The data presented was collected from open sources, Şişecam internal reports and private discussions with Şişecam, Flat Glass and outside experts.

By Prof. Dr. Sener Oktik

Design coatings - a game with colours and performances

The color and performance of glass in buildings are important design elements. Project specific designed coatings can merge the visual intent of architects and building owners with the energy performance requirements of a building. Choosing glass colors from a catalogue with a limited range of options is a thing of the past with custom designed coatings.

Improving the building occupants' comfort whilst enhancing the building performance is possible by using coatings with a variable gradient. A new coating technology offers not only the ability to customize the performance and color of glass so that it interacts with the rest of the building and its environment, but also that a single IGU can be designed as a graded/blended coating. For example, the visible light transmittance in the upper area of the glass unit is high to maximize visible light for comfort, and is then gradually lowered towards the bottom of the unit to reduce heat gain and glare while maintaining an unobstructed view.

When developing a new Low-E coating, one must determine the key targets such as but not limited to L*, a*, b* values (color spectrum), Solar heat gain, visible light and reflection. The presentation focuses on how individual colors perform regarding the Visible Light Transmission, Solar Heat Gain and Reflection. This presentation is a summary of available and upcoming coating technologies for the glass application rather than a scientific analysis of coating technology.

By Stefan Goebel

ABSTRACTS ACCORDING TO PROGRAM

Some recent developments in sputter technology

Today sputtering is one of the key processes for manufacturing of innovative products like all kinds of discs for data storage and entertainment, flat displays, smart windows or thin film solar cells. The invention of the planar magnetron cathode in 1974 allowed the deposition of high performance thin films on production scale. The industrial implementation of magnetron sputtering was accompanied by various milestones. The 1980s may be described as the decade of reactive DC sputtering, the 1990s as the decade of pulsed sputtering and higher target utilization and the 2000s as decade of high ionization. This contribution shows an overview on recent R+D work using sputter deposition at Fraunhofer IST.

Magnetron sputtering will be the key process in the future of films for precision optics. The main challenges are ultra precise control of film thickness and refractive index, reduction of defects and denser films.

Each new sputter technology comes up with applications that had not been possible so far. HIPIMS (High Power Impulse Magnetron Sputtering) was the basis for a development of a 'coat and bend' process developed at Fraunhofer IST. The product is a Low-E glass with an extremely hard indium tin oxide coating. HIPIMS also enables adherent metal films on polymers like PMMA.

Gas flow sputtering (GFS) based on a hollow cathode discharge has shown its high potential for special applications like thermal barrier coatings or magnetic thin films.

Finally, the importance of plasma simulation supporting the experimental work is steadily increasing.

By G. Bräuer, R. Bandorf, A. Pflug, V. Sittinger, B. Szyszka, M. Vergöhl

High rate PECVD technologies for coatings on large area glass and plastics

Because of the recent market requirements for the highly functional coatings on large area glass and plastics, a significant increase of deposition rate of oxide and nitride has been more demanded. Most attractive method to satisfy such requirements is PECVD (Plasma Enhanced Chemical Vapor Deposition), since it may achieve much higher deposition rate than the currently used MF pulse sputtering. In this presentation, magPECVD and arcPECVD of FraunhoferFEP and some other candidates will be introduced with the features of those technologies and discussed about a possibility of being used for the mass production.

By Dr. Koichi Suzuki

Perspectives for inline metrology introduction – System selection and dimensioning strategies

By Marcus Klein

ABSTRACTS ACCORDING TO PROGRAM

From micro to nanolayers – and how to characterize them

I will go over several drivers for the coatings industry. Constant push for cost reduction resulted in new coating technologies such as ALD (atomic layer deposition) capable of applying thinner and thinner coatings, effectively reducing the coating thickness from hundreds of microns to tens of nanometers. Governmental and public push for more ecological solutions that forces to modify coating processes to reduce use of harmful chemicals, but also to reduce water consumption, for instance. And also catering novel application areas that did not exist 20 or even 10 years ago, which require additional functionality of the coatings including biosensors, food packaging, pharmaceuticals. While, these novel trends are slowly moving from research to industry, the characterization of such functionalities is lagging. I will show, how it can be addressed using spectroscopy method of Multi-Parametric Surface Plasmon Resonance.

By Dr. Johana Kuncova-Kallio

Latest developments in thin film solar cells: challenges in research

Photovoltaics (PV) has developed into a mature technology during the recent past. For many years, world-wide installations of photovoltaic systems have increased by more than 40% annually.
Key elements to support and enhance a massive deployment of PV on the global scale include research and development for efficiency improvement, cost reduction and lifetime enhancement of photovoltaic modules and systems along the entire value chain. New materials and device designs may either boost existing technologies or open-up new alternatives.
In Germany, 2.81 GWp solar power has been installed in 2018 compared to 1.66 GWp in 2017. However, to achieve the goal of 200 GWp total capacity by 2050, installations of 5 to 7 GWp will be necessary. But event today, PV produced in 2018 a total of 46 TWh which corresponds to 8.7 % of the electrical energy consumption in Germany. A total of 1.6 Mio. PV systems contributes to this, with a specified power of 45.9 GWp.
This contribution will discuss perspectives and scientific challenges. Examples are high quality crystalline silicon films on glass, a-Si:H/c-Si heterojunction solar cells (HIT), CGIS solar cells and hybrid multi-junction solar cells comprising silicon and organometallic perovskite based light absorbers. Perspectives towards new applications such as color neutral transparent solar cells and switchable solar cells will be given.

By Prof. Bernd Szyszka