ADVANCES IN COATINGS FOR GLASS AND PLASTICS 28.7.

ABSTRACTS ACCORDING TO PROGRAM

Russian Flat Glass Coatings Market Overview

In this presentation an overview on the current market of coated flat glass in Russia&CIS will be given, including the balance between the residential and architectural projects branches, the nowadays situation in governmental legislation and the according building norms, the related trends in glass processing and IGU construction business.The talk will also outline various products market niches, including Low-E, solar control, multiple-silver multifunctional platforms and special-purpose coatings.

by Dr. Dmitriy Bernt, Plasma Coating Process Engineer, NSG Pilkinton Glass, Russia

Future of Architectural Glazing and Glazing for Automotive in Turkey & The Middle East and North Africa region

The population of the world has reached approximately 7,5 billion in 2015, and more than 6% of the world population lives in Turkey (78 million) and the Middle East and North Africa region (Algeria, Bahrain, Egypt, Iran, Iraq, Israel, Jordan, Kuwait, Lebanon, Libya, Morocco, Oman, Palestine, Qatar, Saudi Arabia, Sudan, Syria, Tunisia, UAE, Yemen , 20 countries ~380 million). Turkey has become the 17th largest economy in the world with an average annual real GDP growth rate of 4.7 percent between 2002 and 2015. The 12 OPEC nations are within the MENA region where the estimated world's oil reserves and natural gas reserves in the region are 60% and 45% respectively.

In Turkey and MENA region the construction sector has been using architectural glazing with exponentially growing volume and number of new applications in an attempt to meet the global challenges of the architects in energy conservation, environmental protection and to satisfy customer demand in the field of aesthetics. Thus following the global market trends the architectural glazing market in Turkey and the MENA region is shaped by products combining specialty glass and nanotechnology solutions and integrated design processes.

In Turkey and the Middle East, the high prestige projects require temperable soft coated, high performance products that primarily emphasize safety and security. Many renowned architects who care for color rendering in the first place, prefer low-iron monolithic or laminated lites as far as the back pane of an insulating glass unit goes. On the high-rise buildings side, Emirates countries offer an architecturally visual feast. On panels where lately glass sizes have enlarged, neutral as well as selective products with lowest outer reflection possible stand for the first choice. In this particular region, high performance products are mainly used in order to lower administrative costs and to provide ambient energy control. In North Africa however; darker, reflective products dominate the marketplace where energy control is ensured by poor light thus proportionally lowered energy transmittance. In projects where French norms are prescribed decision-makers often tend towards efficient, solar control products with larger glass units.

Turkey is an attractive base for auto manufacturers for their export sales. ~75 % of production in Turkey is for export and more than 900,000 vehicles were exported from Turkey to foreign markets in 2015. Several manufacturers have R&D and product development, design, and engineering activities in Turkey. In the MENA Region only in 6 countries (Algeria, Egypt, Iran, Jordan, Morocco and Tunisia) are manufacturing motor vehicles and only 1.4% of the world production was in the MENA in 2015. In 2011, number of vehicles manufactured in Iran reached 1.600.000 which made the country 18th biggest manufacturer worldwide. Iran is also the only MENA country which manufactures vehicles with their own brand. Morocco is a fast developing country in terms of vehicle manufacturing in parallel with investments from PSA and Renault of France. In 2015, Morocco assembled 280.000 of the 1.335.000 total

vehicle production in MENA countries. Egypt is the 3rd biggest manufacturers among MENA countries, with close to 50.000 vehicles assembled in 2015.
Glass is an important component for safety and security of passengers in vehicles and within the last decade usage of glass in the exterior surfaces of cars has increased by 15%. IR Cut/Heated Windshields and Solar Control Glass and Water Repellent Glass for side windows for sidelites and backlites, electrochromic sunroofs, head up displays are some of the technological advancements in the automotive glazing industry.
Automotive glass manufacturers in MENA are located basically in countries which have float lines and also vehicle manufacturing plants. A number of manufacturers can be summarized as;
Algeria:1 ; Egypt:3; Iran :4 ; Israel :1 and Morocco:2. Biggest advantage of auto glass manufacturers producing in MENA countries is basically access to relatively cheaper raw material and energy in parallel with locally available natural gas resources. Short backs of automotive glazing manufacturers in MENA region, with the exclusion of Iran and Israel, are limited R&D activity and shortage of trained/ experienced personnel.

by Prof. Dr. Sener Oktik, CTO, Science & Technology Center, SISECAM, Turkey

Glass coating related industry and development in Southeast Asia area

The coatings market in Southeast Asia is expected to fare well due to impressive growth in the construction industry. The optimistic economic conditions anticipated in most Southeast Asia countries is expected to cause these segments to witness buoyant growth, thereby influencing the coatings market. In this talk, I will give a brief overview for glass coating related industry and development in south Asia area. The Coating Glass market analysis includes development trends, competitive landscape analysis, and key regions development status.

by Dr. Shijie Wang, CTO, Science & Technology Center, SISECAM, Turkey

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.

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 Prof. Dr. Guenter Bräuer, ICCG Chairman & Director of Fraunhofer IST, Germany

Spatial Atomic Layer Deposition a novel very fast atmospheric pressure deposition technique bringing new possibilities for nano-scaled and nano-designed coatings for a range of large area glass and foil based applications.

Coating technology for a large range of glass based applications has been long dominated by CVD and PVD processes and sometimes Sol-Gel processes. For foil based applications, on top of these techniques also printing techniques (slot-die, inkjet, etc.) are widely used. None of these techniques are well suited for nanostructured multilayers or graded index coatings with grading differences at the atomic level. In the semiconductor industry, Atomic Layer Deposition (ALD) has become one of the workhorses for the deposition of the high quality, high conformal nanostructured materials nowadays needed. However its largest problem is a very low speed, with batch reactor system depositions sometimes less than 10 nm in 8 hours' time. This slow speed has limited the use in large area and large volume glass and plastic substrate based applications. The invention of Spatial ALD, has changed this completely, with this new technique, speeds up to 100 nm/min for a large range of materials has been accomplished. S2S deposition on Si wafers has been accomplished, and several companies are selling production machinery now. R2R deposition on 50 cm wide webs has been accomplished with remarkable speeds. Several companies, including VDL-ETG and Meyer Burger are selling production equipment, and finally TNO has accomplished this technique for 30x30 cm2 sized glass plates. First production systems will become available for the display industry within a few years.

During this lecture an introduction to the Spatial ALD technology will be given. Accompanied with a range of examples of coatings developed using S-ALD for a range of applications, like Photovoltaics, Flexible electronics, Displays, Barriers, Optical coatings etc.

by Prof. Karel Spee, ICCG Vice Chairman & Consultant of Solliance/TNO, The Netherlands

Recent Developments in Sol-Gel Coatings on Glass and Plastics

Sol-gel processing and wet chemical deposition techniques are efficient means to apply surface finishes to many substrates, like glasses, metals, textiles, and organic polymers. The versatility of liquid precursors has been exploitet to synthesize not only inorganic thin films, but also inorganic-organic (hybrid) polymers with unique properties. The latter materials combine inorganic, predominantly oxidic, and numerous organic moieties deliberately on the molecular scale via chemical nanotechnology. The design of new materials combining e. g. mechanical stability and high barrier properties as well as colourability and easy-to-clean aspects (multifunctionality) becomes possible. Further, active surfaces, fiber-optic sensors, switchable coatings, and self-cleaning functions have been realized.
The former batch processing methods (dip, spin, spray coating) are increasingly replaced by in-line coating machines enabling significant reduction of costs and efficient production of multilayer stacks. Fast curing techniques, like UV-exposure and plasma treatment support this trend. New aspects in synthesis and development efforts concern the use of biogenic and biologically inspired precursors that enable replacement of critical raw materials and pave the way to sustainable and even more highly sophisticated ("intelligent") devices based on new material designs.
Recent developments, commercialized products, and current trends will be presented.

by Dr. Gerhard Schottner, Fraunhofer ISC, Germany

Coating Stress in Reactively Sputtered Interference Filters

Stress in dense and stoichiometric dielectric coatings usually has an adverse impact on the optical and mechanical performance of optical interference filters. High precision interference filters are produced with energetic processes such as pulsed DC magnetron sputtering which create high compressive stress in the coatings.
In this presentation we demonstrate a few examples of how stress impacts the filter performance, mechanically and optically, and present solutions to mitigate the negative impact.
One method to reduce the optical degrading effect of coating stress in a thin film filter is by releasing the filter from the substrate. We will describe the impact of this method on an 8-skip-0 Wavelength-Division-Multiplexing (WDM) filter.
A second option to reduce intrinsic coating stress is by thermal annealing. We will demonstrate the impact on a bandpass filter in the Ultraviolet (UV) spectral range.
Furthermore, in some cases thick all-dielectric coatings can be replaced with significantly thinner metal based filters which result in greatly reduced stress bending moments. As an example, a thick all dielectric Ambient Light Sensor filter can be substituted with a silver-based metal dielectric coating with only the fraction of the thickness. This becomes especially interesting when interference filters are coated directly on active device wafers.

by Dr. Georg Ockefuss, Manager, Viavi Solutions, US

Flexible organic electronics and R2R coating technologies in Fraunhofer FEP

In Saxony of Germany, there is a Euroepan largest cluster for organic eletronics called "OES" composed of 40 companies and 20 R&D centers. Fraunhofer FEP is a leading R&D organization in such cluser and is developing not only wel-known coating technologies but also flexible organic electonics, especially OLED lighting. In the workshop, their current technology development status in the fabrication of flexible OLED lighting onto platic film and ultra-thin glass, ultra- gas barrier coating onto plastic film and anti-reflective coating & tranparent conductive oxide coating onto ultra thin glass will be presented.

by Dr. Koichi Suzuki, Secretary of ICCG, Japanese Representative of Fraunhofer FEP & President of SurFtech Transnational Co.,Ltd., Japan

ICCG12, Wurzburg, June 2018

Introduction to ICCG12 that is held in Wurzburg in 2018.

by Dr. Gerhard Schottner, Fraunhofer ISC, Germany