to define its purpose will in the early stages be largely determined by such milestone events as this conference. The atmosphere of this first meeting was highly encouraging in this regard.

Responsibility for the Society now passes to the German Ceramic Society whose president, Prof. *Hans Hausner*, has succeeded Prof. *Rudi Metselaar* as president of the European Ceramic Society. On the basis of this first meeting one can look forward with confidence to the successor which will be held in Germany in two years time. Those who participated in Maastricht can have been left with little doubt that conferences of the European Ceramic Society will become a regular and respected element in the European materials scene.

Large Area Chromogenics in Gothenburg

By Tord Eriksson *

An international workshop on Large Area Chromogenics took place at Chalmers University of Technology in Gothenburg, Sweden, during a very full day, June 5th. It was organized by CoAT AB, The Center for Materials Science, and Chalmers Industri Teknik under the sponsorship of the Swedish Board for Technical Development. Eight invited researchers lectured on the state of the art of chromogenic materials. 50 invited representatives from industry listened and contributed to the ensuing discussions from, in particular, the applications point of view.

The workshop was opened by Professor *Olaf Meyer*, Head of the Eureka secretariat in Brussels, who gave a very much appreciated lecture entitled "Risk financing of hightech start-ups, especially in international cooperation".

The conference aimed at giving some answers to the following questions. What are the prospects and challenges for chromogenic materials? Where is the frontier in research? What are the applications, and when and how can they be commercially realized?

What is a chromogenic material? The question is certainly relevant since the concept was only recently introduced. The word comes from the greek χρωμα = color and γενεσιζ = creation. Chromogenic materials change their color – or more general optical properties such as transmission, reflection and absorption – due to an external influence such as applied voltage, incident light, temperature etc. These materials are classified as electrochromic, photochromic, thermochromic and some liquid crystal based materials.

Chromogenic materials could in the future be used to regulate the flow of light and/or solar energy through a window so that a suitable illumination and climatic comfort could be achieved. Other applications for these materials involve large area displays, rear view mirrors for cars, sun roofs etc.

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Professor *Granqvist* gave in his lecture a general insight into the prospects and challenges. A lot of applications sectors can be identified: architectural (energy efficiency, lighting), automotive (energy efficiency, anti-dazzling), aerospace (temperature control), information (displays of various kinds), military (camouflage/chamelionism). Technical problems still have to be solved before any commercialization is feasible. Large modulation of the optical properties is desired in many applications. The durability is sometimes an important requirement (in windows). The material has to be integrated in devices. A challenge of a more non-technical kind is that this technology is very interdisciplinary in nature. This means that, for instance, physicists and electrochemists have to cooperate to achieve an understanding of the coloration mechanism of electrochromic materials.

A lot of basic research has to be done in order to understand the mechanisms behind electrochromism. Dr. *Carl Lampert*, Lawrence Berkeley Laboratory, emphasized some research issues. The materials have to be characterized: optical properties, electrical properties, structure and chemistry, determination of coloration mechanism and overall stability. In addition a number of hitherto neglected materials should be studied. As to the complete devices the following aspects have to be considered: compatible ion storage electrodes, ion conductors for small positive ions such as $Li^{\oplus}$, $H^{\oplus}$, $K^{\oplus}$, polymeric electrolytes for lamination (an all solid state device is desirable), development of fabrication techniques, determination of device operating characteristics and stability testing of prototype devices.

Dr. *N. Lynam*, Donelly Corp., lectured on applications for electrochromic materials. Donelly is producing an electrochromic rear view mirror for cars. The design of such a device differs from that intended for a window in that it is not transparent but reflecting. The materials choice is also simpler since not all layers in the device have to be transparent.

ADVANCED MATERIALS

Dr. *Montgomery*, General Motors Res. Labs, reviewed the various existing liquid crystal systems and concentrated on those appearing to be most suited for large area switching devices. The polymer-dispersed and encapsulated liquid crystal films are either opaque (scattering) or transmitting, depending on the mismatch or match of the refractive indices of the liquid crystal particles and the host polymer. The operating temperatures are limited to the range $-20\,^{\circ}C$ to $+100\,^{\circ}C$. The response time makes them useful for most outdoor applications such as: solar control, automotive privacy, signs and eventually automotive displays. The on-state transmittance ($\sim 65\%$) restricts their use in areas where higher transmittances are required: windshields in cars and windows in buildings. For the future it seems important to reduce haze, increase durability, reduce operating voltage and improve solar attenuation characteristics so that this technology can find applications beyond its present technical limits.

Photochromism can be defined as a light-induced reversible photochemical process which results in a color change. The photochromic systems can be classified as either inorganic, organic, or those applying photophysical processes. Dr. *N. Chu*, American Optical Corp., suggested the following candidate materials: photochromic glasses, photochromic plastics activated by silver halides, and photochromic plastics activated by spirooxazines. The spirooxazines change from colorless to blue. They could find applications both in automotive windshields and sunroofs as well as for retrofit polyester films in glazings and window shades. However, the R&D program for the spirooxazines seems still to be in its infancy. The temperature sensitivity may be a problem, particularly in automotive applications. Also the light fatigue resistance limits the product lifetime and needs to be improved for window applications.

Dr. *T. Hjertberg* reported on research on conducting polymers. He identified the problems involved as: low stability, difficulties in processing due to bad mechanical properties and lower conductivity than desired. Dr. *O. Wennerström* reported on photochromic effects in organic materials.

A program that has caught a lot of interest is that reported by Professor *T. Lagervall.* His ferroelectric liquid crystal devices have an extremely short switching-time in addition to high contrast angles. This technology has already been commercialized by Canon for high definition information screens.

Professor *C.-G. Granqvist* reported on research carried out on a new electrochromic device based on Li_xWO_3 and VO_5. A new polymeric electrolyte with adhesive properties is applied as a lamination material in a five layer structure. He also reported on some very interesting results on thermochromic coatings made of VO_2. However, durability still has to be verified before marketing. The electrochromic device has reached the point of process development which has been triggered by the advent of the new solid polymeric electrolytes.

The workshop on Large Area Chromogenics was a very exciting and important meeting. Most intriguing is the fact that this area involves a large amount of high level basic research and will have a huge potential impact on daily life when this technology enters the market. It seems to be a supreme example of the synergetic effects achieved by combining academic research with industrial product development.

Storage and Transfer of Molecular Information in Strasbourg

By Jean-Paul Behr *

The European Parliament in Strasbourg housed the first congress "Espaces Européens des Sciences" from July 2–6, 1989. This symposium was organized by Fondation Alsace under the scientific direction of *J. M. Lehn* and *P. Chambon* and made possible the meeting of some thirty world renowned biologists, chemists and physicists to think over a common theme: "Storage and Transfer of Molecular Information". Although the time schedule was planned to imbricate disciplines and research fields, all lectures were centered on recognition processes at the molecular level, involving either the complex functions that workers in contemporary biology are trying to understand, or the highly elaborate molecules or molecular assemblies that chemists are able to make and handle, or approaches to the study of molecular signals and addressing that physicists are developing.

G. H. Khorana (MIT) opened the symposium by showing how light is transduced into chemical signals through rhodopsin molecules in highly organized systems as different as the eye's visual receptor cell and a photosensitive bacteria. The cascade of events in the former system was followed further down to the level of the nerve by *L. Stryer* (Stanford)

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