

From East-West 1 to East-West 5, from Micro- to Molecular engineered Material Design.

The Past and the Future of AgX-imaging Systems.

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Abstract

Since the first East-West conference in 1984 the technical capabilities of AgX-imaging systems have tremendously increased. Although the replacement of AgX-based technology by digital imaging technologies was predicted at the end of the seventies, the volume worldwide of AgX-based imaging systems was never as large as it is today.

In the meantime the imaging industry has largely changed by the entrance of new competitors and new technologies, by the development of new parterships and by the immense possibilities the internet is offering. This will reshape the imaging industry.

The evolution in AgX-crystal design, emulsion design and the research methods from East-West 1 to East-West 5 will be discussed. It will be examined how they have influenced the applications in the consumer imaging area. Further growth will largely depend on how far new AgX-imaging capabilities can be industrialised at the satisfaction of the customer, how they will fit in the digital and hybrid roadmaps of the new applications and how we will find our place in the new shape of the imaging industry towards 2010.

Introduction

The International East-West Symposium was organised for the first time in 1984 on the island of Maui Hawaii under the leadership of Dr.P.Gilman and Prof.Hirosho Kokado of the Tokyo Institute of Technology. It brought together the scientists of the industrial and academic research in AgX-imaging technology from East and West on a middle ground for scientific discussions on the physical and chemical properties of the silver halides which influence the photographic sensitivity. The main focus of this conference was on "Factors influencing Photographic Sensitivity". The Symposium was at the same time a try-out of a joint organisation between "The Society of Photographic Scientists and Engineers" which later became the IS&T and "The Society of Photographic Science and Technology of Japan".

East-West 1 was a trendsetter in different domains. For the first time an analysis of the "Factors influencing Photographic Sensitivity" was presented and the top professionals discussed the different origins of the inefficiencies in the AgX-imaging systems (poor light absorption, quamtum losses through recombination and dispersion of the latent image). They concluded that a systematic analysis of the inefficiencies was indispensable for AgX-imaging to continue to grow and to hold its position as the best imaging material with the highest image quality.(1)

This framework would become the basic model of interaction in the scientific AgX-community regarding photographic sensitivity.

Major contributions to East-West 1 came from the work on the critical size of the latent image and its relation to the quantum sensitivity (2,3) , the mechanistic study of anomalous efficient spectral sensitization by desensitizing dyes (4) and the simulation of multilevel-grain development and its influence on granularity which opened a new way for improving image quality in the color negative area.(5)

After the success of 1984 the second symposium was organized on the island Kona Hawaii in 1988 with as focal point the "Factors Influencing the Efficiency of Photographic Imaging". In the meantime tabular microcrystal technology was succesfully introduced into the market which was a major breakthrough for maximizing optical absorption in a multilayer color negative format and opened a new era for emulsion development. A lot of attention was paid to the aspects of emulsion technology like the elucidation of internal structure of tabular microcrystals (6,7) and the epitaxial site selective sensitisation of tabular grain emulsions (8).

The concept of multistructured microcrystals and the effect on carrier separation was demonstrated on octahedral microcrystals (9) which proved the possibility to enhance quantumsensitivity by introducing nanolayers of different iodide containing AgBrI-phases.
The multilevel grain dedection was experimentally proven (10) and a loss process associated with dye formation and light absorption depending on the size of the microcrystals (sizes bigger dan 1 micron) was found and analysed.(11).
The third East-West Symposium (the last that had the Hawaian islands as conference location) was organised in 1992 and saw a growing interest of the european AgX-research and development scientists.
New research tools were demonstrated for the first time on Maui in applications to the silver halides as atomic force microscopy (trying to unveil the real nature of the AgX (111) surface), high resolution electron microscopy (in search for the atomic inner structure around the twinning plane in AgX-tabular crystals) and diffuse reflection spectroscopy which was for the first time applied to reduction sensitized microcrystals .
Major contributions to the advances in microcrystaldesign at that moment came from the proof of concept of making monodispersed tabular silver halide microcrystals (12), the proven concept of the preparation of hollow silver halide emulsion grains (which never made it to the industrial stage) (13) and the demonstration of the role of the twin plane in the interstitial capture and how a surface layer of iodide can shift the position of the latent image away from the twin plane.(14)
The physical nature and the role of silverdimers in reduction sensitized AgBr emulsions was for the first time unveiled by spectroscopical techniques. (15) This work announced a very intense activity in this area during the following years in the hope of finding a stable active holetrapping AgX-emulsion system with a quantum sensitivity close to 2.
Finally at Vancouver on the East-West Symposium 4, the details of the twinning event and platelike crystalgrowth in tabular crystals were elucidated (16,17) aswell as tabular (100) AgX growth (18), the proof of interaction of holes on silverdimers was given by Hirano (19) and the first molecular images of dyes adsorbed to a pseudo AgBr(111) were shown to the world .(20)

Conclusion

Over the last 20 years a steady shift from design on the microscopic level to design on the nanoscopic level has resulted in a tremendous increase in imaging capabilities of the AgX based systems at a very favourable cost. In parallel new and powerful research methods accelerated the research operations. The next step will bring us into the area of the material design on the supra-molecular and molecular level .
Further growth will largely depend on how far new AgX-imaging capabilities can be industrialised at the satisfaction of the customer, how they will fit in the digital and hybrid roadmaps of the new applications.

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Biography

Rene De Keyzer graduated at the Free University of Brussels as a chemical engineer in 1976 .He received a master degree in material science from the Free University of Brussels. In 1978 he started his industrial carreer as a process engineer at Agfa-Gevaert N.V. Belgium.

From 1983 he joined the research and development group of the graphic arts division where he was responsible for the development and introduction of a new line of graphic art film and paper systems and for the research on a new offset system.

From 1988 he joined the corporate research group at Agfa -Gevaert N.V. Mortsel where he was responsible for the basic research on new imaging systems and processes.

He founded Agfa 's research network on nanostructured material design and applications. The network brings together academic and industrial research groups in Europe and abroad in the field of nanostructured materals for imaging and printing applications.

In 1998 he was appointed general program chairman of the "International Congress on Imaging Science" "Exploring New Tracks in Imaging" that was organised in Antwerp Belgium.

Currently he is manager of the external R&D groups of Agfa's Materials Research and Development.

His current scientific interest is in growth processes of micro- and nanocrystals and nano- and molecular clusters in surfaces aswell as 2-D organised organic surface layers, their chemical and physical behavior and their application .

He is a consultant to the European Commission 5th Framework R&D Program .

He is vice-president of the Society of Imaging Science and Technology and president of IST-Europe. He is programcoordinator of the Digital Production Printing and Industrial Applications Congress "DPP2001" a global congress about the "Future of Printing" that will be organized from 13th till 15th of May 2001 in Antwerp Belgium.