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SPIE Eco-Photonics 2011

Sustainable Design, Manufacturing, and Engineering Workforce Education for a Green Future

Pierre Ambs
Dan Curticapean
Claus Emmelmann
Wolfgang Knapp
Zbigniew T. Kuznicki
Patrick P. Meyrueis
Editors

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Introduction to SPIE Eco-Photonics 2011

34 years ago, In 1977, the first SPIE conference in Europe opened in Strasbourg. This conference gathered 700 attendees and was dedicated to optical metrology, 3D displays, and emerging optical telecom. It was held in the amphitheatre of the new building of the Council of Europe that was not yet used by the European representatives.

So it can be said that Strasbourg and its European organization represent a tradition of hospitality for new events in photonics considered as enabling technologies—it is now acknowledged as one of the five KET (key enabling technologies) by the European Union as it was said by Mr. Rubig from the European Parliament (president of the STOA group).

Thirty-four years ago photonics was quite far from ecology which was just emerging as a marginal concept. Now photonics enable active and relevant ecologic applications through engineering. This is a mature way for photonics to contribute to human welfare. Now at least photonics ecology technology, also called green photonics or ecophotonics technology, plays a role to progressively reduce the worsening of some earth inhabitants' living conditions that can result from an inappropriate management of the stock of materials that constitute energy resources (uranium, coal, petrol, gas, etc.).

We are "borrowing the Earth from our children" author de Saint Exupéry said. To return to our children an Earth in which they can have the best chance to have a satisfactory life there are two approaches: to reduce all the activities consuming energy, for instance: traveling, heating, communicating, computing, etc. by organizing a "negative growth"; or to induce a smart growth by using enabling tools, such as photonics, to spend less of Earth's stored energy resources and using more renewable energy, and by using devices allowing the same, or even better service than previous device generations, with less energy and pollution for manufacturing, using, and recycling. Rare materials have to be avoided in new product to preserve their strategic uses in the future, as well as poisonous ones to avoid destroying any part of the Earth's potential. This positive approach can be effectively controlled by using appropriate technologies including photonics.

In this first ecophotonics conference a range of photonics technologies used or to be used for the purposes introduced above are presented. Many innovations proposed in the conference are disruptive. They show that what was previously considered as being utopic are progressively becoming reality. This is the case, for example, of the doubling of efficiency of solar cells, and provide the hope of rapidly reaching a grid parity challenging nuclear electricity, at least as a beginning, at peak hours.

In fact we realize that photonics progress is giving birth to a lot of innovations in other domains (for instance: progress in the design and control of an electric or telecom network to provide electricity exchanges between electricity users instead as providing only a one way access from the power station to the subscriber, and to minimize the electricity consumption of a telecom network by a smart control of its capacity.

Into new large human systems organizations, including education, social constraints will be induced in areas where the advantages of ecophotonics are provided. It will be, for instance, possible to exchange energy between individuals as messages are exchanged through the internet, inducing a new social relation with energy.

It is clearly perceived now that the concern for ecophotonics technologies will lead to significant changes in transportation, biomedicine, communications, media, etc.

This proceedings volume presents a limited number of papers that were selected for coverage of some advanced examples of ecophotonics' main concerns for this first green photonics conference. This conference showed the interest that exists in this program as this first experimental conference opens the way.

We have no doubt that the conference met the expectations of the ones who worked to prepare it and the attendees, and that the proceedings will raise the interest of all its readers waiting to be involved in one way or another in ecophotonics progress.

The next conference on this topic will be larger in 2012 and will include new topics linking photonics and ecology through science and technology without forgetting business.

Pierre Ambs
Dan Curticapean
Claus Emmelmann
Wolfgang Knapp
Zbigniew B. Kuznicki
Patrick P. Meyrueis

Introduction to Sustainable Energy Engineering

We had the privilege and the pleasure to chair this session of the first European conference on Ecophotonics that was opened by a European Parliament address.

It is sometimes difficult to be the first in a row and to open the way. Even if ecology is now a well recognized discipline in Europe, the wedding with photonics, one of the five key enabling technologies acknowledged by the European Union, is not yet really celebrated. We hope that this conference will constitute an international wedding celebration and that after this wedding many offspring will follow. Such will be the case in the framing of the next Photonics Europe in Brussels.

There is no doubt that ecophotonics will rapidly become, because of many needs, a leading photonics discipline. The strong interest among young scientists and engineers in future European developments expected in ecophotonics is a strong signal.

Ecophotonics is a young discipline having a bright future based on a pluridisciplinary approach centered on photonics. Ecophotonics concern almost all the photonics applications already validated in which ecophotonics will bring new paradigms.

The purpose of an R&D program is becoming more and more not just the excellence of the performance results of the outputs of the R&D. Traditional R&D results lead to a product that proceeds faster, with more accuracy, is more friendly for its user, provides more services etc. Because of increasingly important ecologic concerns, it will be excellent if it is also better in saving energy; if it is free of pollution of any kind in its operation, manufacturing, and recycling; and if the amount of rare material involved in its realization is low, and beyond all that—if the workers produce it in acceptable working conditions.

In fact it is a new ecoculture that is arising, associated with a new ecotechnology and a new ecobusiness, in which photonics could be showing the way. That is what we explore in this session as well as all the other ones in this ecophotonics conference.

In this session very important new advances in solar energy conversion are disclosed for the first time. In the race for ecoefficiency of solar light to electricity conversion some validated results show that the leadership in the efficiency race could be in Europe with European disruptive technology.

Patrick P. Meyrueis
Zbigniew T. Kuznicki

Introduction to Sustainable Manufacturing Development and Processes

This session provides an overview on how photonics based manufacturing technologies will impact environmental friendly production of the future.

Plenary presentations from the European Laser Institute and the European Photonics Industry Consortium show the importance of photonic manufacturing being a key component of agile, lean, and green manufacturing. The European technology platform Photonics'21 serves to prepare the future European research agenda.

Plenary and technical presentations demonstrate the wide range of manufacturing applications, from new energy efficient generation of high power laser light to more efficient direct manufacturing techniques in aerospace applications, to the improvement of mechanical properties, lifetime extension of high reliability of structural components, and environmentally friendly assembly of thermoplastic materials. Furthermore, technical presentations cover the impact of European environmental directives for glass manufacturing as well as the importance of virtual reality to simulate large lighting with high efficiency LEDs.

Wolfgang Knapp
Claus Emmelmann

Introduction to Education for a Sustainable Engineering Workforce

In our consideration of the global perspective of eco-photonics, we consider Education for a Sustainable Engineering Workforce as one of the most important tasks of the conference.

The focus of the invited papers was set on the global outreach activities, promoting worldwide photonics education. The view was not only focused on the academic (university) level, but rather tried to cover all levels. Also, the efforts of the UNESCO in promoting the physics and especially the photonics courses were underlined by the speakers. Using modern optical devices, like touch screens and optical fiber, the classrooms can be outsourced onto mobile devices, and mobile learning is a new paradigm in teaching optics and photonics. The next generations of scientists will grow up in a world with education in optics and photonics for a green future. They will understand as schoolchildren how solar cells, lasers, quantum computers, and complicated optical devices work, and will be able to improve their efficiency and to discover new and fantastic effects in optics and photonics.

Patrick P. Meyrueis
Dan Curticapean

Introduction to Photonics in Sustainable Product Design

The SPIE Eco-Photonics Symposium demonstrated that photonics is an important actor for a "green" future and, therefore, photonics must be included at the design stage of eco-products.

The session "Photonics in Sustainable Product Design" covers areas where photonic devices and systems are designed into products because of their improved performance, longer lifetime, ease of disposal, better overall economics, etc.

Eight papers were presented including one keynote and two invited papers. The different papers illustrate the increasingly significant role of photonic technologies in reducing our environmental impact. Examples concerning a broad field are discussed, for example, laser manufacturing, solid-state lighting, solar cells, and optical communications.

Several papers are related to telecommunications and to improvement of the energy efficiency of telecommunication networks. They show the importance of photonic technology for this task.

Display technology is another field where photonics has a key role in the design of sustainable and energy efficient products.

In conclusion, all the papers of this session show that photonics has an important potential in the design of "greener" and sustainable products in a large number of industries.

Pierre Ambs