the last word:
Collaborative nanophotonics

Director General of the European Photonics Industry Consortium, **Carlos Lee** appeals for better connections between world-leading European nanophotonics research groups and industry

NANOPHOTONICS IS CONCERNED with the application of photonics at nanoscale dimensions, where field enhancement effects result in new optical phenomena, offering superior performance or completely new functionalities in photonic devices. It is an enabling technology that has the potential to impact a wide range of photonics products, ranging from high-efficiency solar cells to ultra-secure communications and personalised health monitoring devices able to detect the chemical composition of molecules at ultra-low concentrations.

NETWORKING FOR NANOPHOTONICS

The field is currently having a prominent role in innovations being investigated and introduced in different areas. In particular, nanophotonics structures are being introduced in technologies where enhanced light-matter interaction can result in significantly better performance of existing devices, like biochemical sensors, photovoltaics, solid-state lighting or integrated optics. Moreover, a range of new applications are surfacing, where nanophotonic structures are enablers for new functionalities, like in the case of quantum optics or plasmon-enhanced magnetic storage.

GREAT EXPECTATIONS

"The Nanophotonics Europe Association, in its mission to promote nanophotonics by forging partnerships between academia and industry, organises […] a series of workshops where industry and academia discuss the current advances and identify areas where collaboration can be particularly beneficial," explains Gonçal Badenes, President of the Nanophotonics Europe Association, and manager of the NanoFabrication Lab at ICFO in Spain.

One such workshop took place on 24 September within the 29th European Photovoltaic Solar Energy Conference and Exhibition (EU-PVSEC2014) in Amsterdam, The Netherlands, and was devoted to identifying opportunities in photovoltaics. "The photovoltaics community continues to look towards nanophotonics with great expectation, especially as the need for novel concepts is clearly recognised as a driver for future innovation and commercial competitiveness of the sector," underlined Thomas Krauss, Chair of Photonics and Head of the Photonics Group at the University of York, UK.

Several prominent researchers highlighted fantastic progress being made in Europe:

- **Jan Christoph Goldschmidt**, Head of Team Novel Solar Cell Concepts, Fraunhofer Institute for Solar Energy Systems (ISE), Germany, reported progress towards making "good cells better" using nanophotonic light trapping concepts on solar cells with state-of-the-art performance
- **Lucio Andreani**, Professor at the University of Pavia, Italy, highlighted the interplay between photonic and electronic properties of nanostructured solar cells, and showed that both could be satisfied with careful design
- An unexpected benefit of using plasmonic field enhancement was reported by **Erik Garnett**, Group Leader for Nanoscale Solar Cells at AMOLF, The Netherlands, in the context of thin films loaded with silver nanowires to act as transparent conductors. He showed that plasmonic hotspots could be used to weld the nanowires together, thereby improving the electrical conductivity of the thin films, to the extent that they could rival or even outperform indium tin oxide in terms of both conductivity and transparency
- Roll-to-roll processing for organic solar cells was discussed by **Toni Müller**, Team Leader in Lifetime and Characterization, Heliatek, Germany, and was identified as a promising method for imprinting nanostructures into solar cells, also given the fact that holographic Christmas wrapping paper is being produced cheaply by a similar process
- **Kylie Catchpole**, Associate Professor at the Australian National University, highlighted that the next generation of high-performance tandem cells could benefit significantly from light trapping and related nanophotonic techniques, but that it was much more difficult to implement than in single junction cells, hence providing an exciting challenge
- In the final presentation, **Christopher Case**, CTO of Oxford PV in the UK, then expanded on the properties and opportunities of perovskite materials, also pointing out the opportunity of using them in building-integrated photovoltaics. In the discussion, light trapping was mentioned as a way to reduce material thickness, thereby improving electrical transport properties while maintaining optical absorption

ADVANCING INNOVATIONS TO MARKET

Research into nanophotonics is actively addressing potential applications across a wide range of subjects, with European groups leading at the worldwide level, but the connection to industry is still relatively weak. If these connections can be strengthened, European industry will be in an exceptional position to exploit nanophotonics and deliver novel technological solutions. This represents a phenomenal opportunity that should not be missed.

EPIC is an industry association that promotes the sustainable development of organisations working in photonics in Europe. For more information, please visit: ***www.epic-assoc.com***

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