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Linking Nanoscale to Giga Watts

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Nanotechnology and nanomaterials are enablers of innovative devices and systems in the domain of ICT, wireless communication, medical devices. However it is largely ignored that also in the domain of Energy these developments will have major impacts. It is clear that in the domain of Smart Grids and Smart Cities, sensors and the wireless communication amongst these sensors will play a crucial role, but the focus of the presentation will be on how electricity generation, electrical energy storage and power electronics will be influenced by the developments in the nano-domain.

It becomes more and more obvious that, in order to fight climate change, distributed electricity generation by renewable energy sources will be key to reduce CO_2-emissions. Amongst the renewable energy sources wind and solar energy have by far the largest technical potential in combination with cost-effectiveness to ensure economical viability. The presentation will focus on the approaches to insert nanomaterials and technologies in advanced (e.g. crystalline Si) and novel photovoltaic devices (e.g. perovskite-based thin-film solar cells) in order to increase their performance and achieve a further cost reduction. However intermittent sources like wind and sun have to be deployed hand-in-hand with new and cost-effective energy storage solutions as to ensure continuous equilibrium between electricity generation and consumption. Electrochemical storage in batteries near to the location where the energy is generated and consumed are certainly part of the solution. In this domain the developments on nanomaterials will improve the energy and power density of batteries by enabling nanosized particles with mixed ionic and electronic conductivity for the electrodes whereas the amount of passive material is reduced by the use of thin solid-state electrolyte layers. Last, but not least, in the electricity grid of the future electrical energy flows will be bidirectional (to and from the prosumer). This will require efficient convertors. This is enabled by novel devices based on high-bandgap materials like SiC and GaN and device structures in which nanosized features will be essential to obtain proper device operation.

Biography:

Dr. Jozef Poortmans received his degree in electronic engineering from the Katholieke Universiteit of Leuven, Belgium, in 1985. He joined the newly build Interuniversitary Micro-electronic Centre (IMEC) in Leuven where he worked on laser recrystallization of polysilicon and a-Si for SOI-applications and thin-film transistors. In 1988 he started his Ph.D. study on strained SiGe-layers. Both the deposition and the use of these SiGe-alloys within the base of a heterojunction bipolar transistor were investigated in the frame of this study. He received his Ph.D. degree in June 1993.

Afterwards he joined the photovoltaics group, where he became responsible for the group Advanced Solar Cells. He was involved in the start of imec-activities on thin-film crystalline Si solar cells, organic solar cells and III-V solar cells and became Department Director of the PV-department in 2003. In 2008 he started up the Si-PV Industrial Affiliation Program and collected the investment funds to build up the advanced Si-PV R&D-line of imec (S-line). As Program Director PV he built the industrial partnership active in the S-line. Presently, he is Scientific Director of the PV and Energy activities of imec since 2013. In the same year he was also appointed imec Fellow.

He has been a Board Member of Eurec Agency and is presently member of the Steering Committee of the EU PV Technology Platform. He also acted as General Chairman of the 21st European Photovoltaic Solar Energy Conference & Exhibition and of the SiliconPV 2012 Conference and has been active in the Scientific Committees of the leading PV-conferences.

Prof. J. Poortmans has authored or co-authored more than 500 papers that have been published in Conference Proceedings and technical journals. Since 2008 he is part-time Professor at the K.U.Leuven, where he teaches courses on photovoltaics and materials in electrical engineering. In 2013 he became also part-time Professor at University Hasselt where he teaches a course on analog electronics. In the same year he was appointed imec Fellow. Since September 2016 he is Coordinator R&D-strategy of Energy Ville, an institutional partnership between imec, VITO, KULeuven and University Hasselt focused on the themes of Smart Cities and Smart Grids.