Sustainable - Green & Trusted

The journey towards green and carbon neutral electronics: Ecodesign, materials and supply chain management

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Abstract

Carbon neutrality targets, the Sustainable Development Goals (SDGs) and circular economy policies currently trigger a wave of activities towards reducing environmental impacts of electronics, on the product, component and process level. This presentation provides the broad picture of electronics life cycle impacts, summarises current drivers, including company policies and initiatives of the European Union in particular, and how industry is responding and needs to respond: Extending the coverage of carbon reporting towards the supply chain to identify hot spots to tackle, efforts to keep materials in the loop and how emerging technology concepts face new circularity challenges. The presentation comprises examples from carbon accounting, discusses bio-based materials as a potential "green" alternative and sustainability challenges of structural electronics.

Biography

Karsten is Group Manager Product Ecodesign and Circular Materials at Fraunhofer IZM. He has more than 20 years of experience in applied research on sustainability of electronics. Since 2008 he is coordinating large European research and innovation projects in the FP7 and Horizon 2020 programme, including projects on recycling of post-consumer plastics for new electrical and electronic equipment and on eco-design of smart mobile devices. He is involved in projects for the European Commission to shape eco-design and energy label policy for ICT products. Currently he leads a project for scope 3 carbon accounting in electronics supply chains

The sustainable edge computer - the greenest data centers for smart cities and citizens

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Abstract
With the increasing digitalization and usage of applications such as artificial intelligence and the resulting high processing of data, the energy consumption in data centers is rising dramatically. By 2030, statistics show that digital infrastructures will contribute to 4-6% of the total global electrical consumption. Mainly driven by growth of hyperscale datacenters as well as from the growing decentralized edge computing infrastructure. Cloud&Heat's energy-efficient direct hot water cooling makes it possible to decrease the carbon footprint while reusing the waste heat of data centers and running them on local renewable energy.

Biography
Dr. Jens Struckmeier is a physicist, inventor and entrepreneur from Germany. Whilst still a student, he initiated and was responsible for planning the first fully green passive house in North Rhine-Westphalia, for sustainable living without a conventional heating system. Between 2000 and 2003 Jens worked as a project lead in device and software development in Santa Barbara, USA. From 2004 to 2009 he successfully founded and managed a German nano-biology instrumentation company (eventually bought by Bruker). In 2009 Jens started developing water cooling systems for data centers, which led to the foundation of the green computing business Cloud&Heat Technologies. Since then, the vision of the Dresden-based company has been to make sustainability the driver of digital innovation. Cloud&Heat develops, builds and operates energy-efficient, green, secure and scalable (edge) data centers, meeting the growing demand for distributed and highly available IT infrastructures. Jens is not only the driving force behind the company’s hardware development but is also focused on a variety of other topics, such as data security, AI, AR, VR and blockchain. Jens’ disruptive inventions have led to Cloud&Heat being awarded several innovation prizes, including the Saxon environmental prize in 2013; the German Data Center Prize in 2015, 2016 and 2019; the European Culture Innovation prize in 2018 and being named the Deloitte Fast 50 winner in 2019. Jens is frequently invited to both national and international conferences as a keynote speaker and was named Best Speaker at the German Data Center Day 2016.

SiC Power MOS technology evolution as an example for sustainable and efficient energy conversion in DC grids

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Abstract

The commercialization of 4H-SiC power devices for industrial and automotive applications is in full progress. Cost pressure and technology innovation are pushing device performance to the next level. Conversely, further progress is become more challenging in modern manufacturing technologies due to the increasing effort towards device optimization. Distinct optimization of wafer material, technology, design, processes and manufacturing tools will be required. Moreover, application specific devices will be tailored towards new markets and the resulting requirements.

In order to visualize the progress revolving around SiC power device evolution, the technology and design innovation history for VDMOS transistors is reviewed first. This includes wafer quality and diameter, design improvements using JFET implantation and cell shrink. Other power device topologies like TrenchMOS and SuperjunctionMOS will be briefly mentioned.

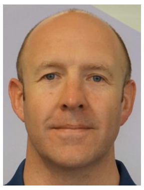
Then, device optimization strategies are discussed. This includes trade-offs between on-state resistance, blocking voltage (performance), surge current and avalanche capability (ruggedness) as well as gate oxide reliability and yield. Requirements for sustainable and efficient energy conversion in DC grids are considered in this example.

Finally, a basic roadmap is presented to project further optimization strategies like overlay accuracy, wafer grinding, alternative wafer materials and yield optimization (e.g. for thermal oxidation, wafer substrates). The roadmap is then evaluated against material and manufacturing tool requirements for next device generations. Also, a comparison to TrenchMOS and Superjunction MOS technologies and their benefits and drawbacks will be explained. Here, additional opportunities for manufacturing tools can be identified.

Biography

Tobias Erlbacher received the Diploma in Electrical Engineering (Microelectronics) from the University of Erlangen-Nuremberg in 2004, and his Ph.D. degree in 2008. Since 2009, he is with the Fraunhofer Institute of Integrated Systems and Device Technology IISB in Erlangen, where he is heading the “Semiconductor Devices” Department. Additionally, he is an appointed lecturer at the University of Erlangen-Nuremberg since 2015. His research activities focus on device modelling, design and integration as well as technology development for power electronics. This includes the monolithic integration of passive networks and the optimization of power semiconductor devices in silicon integrated circuits. Moreover, Dr. Erlbacher is working on design and development of silicon carbide devices for power applications, high-temperature integrated circuits and sensors. He also has expertise with non-volatile memories and device characterization at the nano-scale. He has authored a book on lateral power transistors in integrated circuits. He has authored and coauthored over 120 papers in scientific journals and conference, and he contributed to 15 patent families.

Sustainable AI: Measuring and Reducing the Carbon Footprint of Deep Learning Model Development and Inference



J. Kelleher
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Abstract
Artificial Intelligence (AI) has become a pervasive technology in modern societies. Naturally this has resulted in questions being raised regarding the ethical use of AI. However, a relatively under-studied aspect of modern AI is the relationship between AI and the environment. Used correctly AI has the potential to help our societies become move environmentally sustainable. At the same time modern AI, and in particular large Deep Learning models trained with powerful computers using massive datasets, have a direct environmental cost. In this talk I will discuss the environmental cost of modern AI practices and describe some of the ongoing research that is attempting to make AI more environmentally sustainable.

Biography
John is a Professor of Computer Science at Technological University Dublin. He is the Academic Leader of the Information, Communication and Entertainment (ICE) research institute, and a co-Principal Investigator at the Science Foundation Ireland ADAPT research centre, and a co-Principal Investigator at the SFI centre for PhD training in digitally enhanced reality (D-REAL). John has over 25 years of research experience in Artificial Intelligence, with a focus on the topics of natural language processing and machine learning. John has authored three books: Fundamentals of Machine Learning for Predictive Data Analytics (2020, MIT Press), Deep Learning (2019, MIT Press), and Data Science (2018, MIT Press). John's lab carries out research on natural language processing, machine learning for health and alsoo on the carbon footprint of deep learning. John's presentation at SEMICON will be on this last topic, the environmental impact of artificial intelligence.