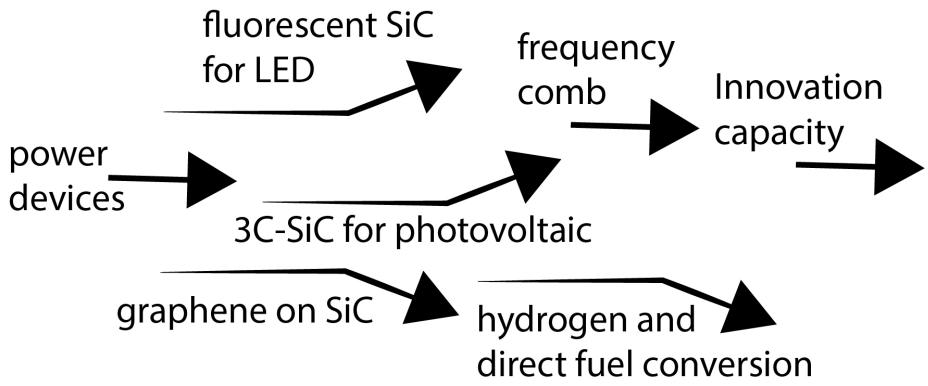
Future of research and innovation in energy materials concepts of today: the utilisation motivation in European and international context

Mikael Syväjärvi[1*], Mysore Sridhar Santosh[2], Robert Pilemalm[1], Rizwan Raza[3], Muhammad Imran Asghar[4,5]

[1]JMS Center for Research Utilisation | ALMINICA AB, Ulrika, SE-59053, Sweden
[2] Centre for Incubation, Innovation, Research and Consultancy (CIIRC), Jyothy Institute of Technology, Tataguni, Off Kanakapura Road, Bangalore - 560082, Karnataka, India.
[3]Clean Energy Research Lab (CERL), Department of Physics, COMSATS University Islamabad, Pakistan
[4]New Energy Technologies Group, Department of Applied Physics, School of Science, Aalto University, P.O. BOX 15100, FI-00076 Aalto, Finland
[5]Faculty of Physics and Electronic Science, Hubei University, Wuhan, Hubei, 430062, China

Graphical Abstract



Abstract

We present the concept of advanced material evolution from research to innovation as utilisation route to address future needs. As case study, we present a starting point original research in silicon carbide growth. From initial materials growth to develop material for power devices, the research in growth methods and processes evolved into various avenues such as epitaxial graphene, fluorescent silicon carbide for white light emitting diodes in general lighting, solar conversion technologies, and to frequency comb generation to explore increase of data traffic to more than 100 TB/s. Further, the hydrogen to electricity conversion and direct fuel conversion are novel approaches which include aspects in semiconductor materials and the hydrogen future. Through the hydrogen the research further expands into advanced materials aspects such as metallic coatings for hydrogen storage. In this presentation we discuss the innovation and utilisation aspects from the advanced materials research and innovation.

Keywords: silicon carbide; energy materials; semiconductors; hydrogen

Acknowledgements
M.S. acknowledge funding from the European Union's Horizon 2020 framework programme for research and innovation under grant agreement n.899679, The Swedish Energy Agency, European Commission in European Union's Horizon 2020 research and innovation programme under grant agreement no. 775970. M.S. and R.R. acknowledge funding from Swedish Research Council (project 2015-05876), HEC-NRPU Project, M.I.A thanks the Hubei Talent 100 program and Academy of Finland for their support (Grant No. 13329016, 13322738). M.S.S. acknowledges the funding support by the Department of Science and Technology, Govt. of India under the Trans-National Collaborative RD&D program (TMD/CERI/MICALL19/2020/01).