

7th Annual Congress on

Materials Research and Technology

February 20-21, 2017 Berlin, Germany

Approaches to reduce material consumptions in photovoltaic

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Renewable energies are now established as main stream energy resources world-wide. The outlook at the market mainly depends on cost-competitiveness, policy initiatives and regulations, on energy security and environmental issues, as well as on availability to cover the global demands. Among the renewables in the electricity sector today, photovoltaic meet these key indicators exemplarily. Consequently, in the hi-Ren scenario of the International Energy Agency with an annual 6300 TWh electricity production PV provides 16% of global electricity by 2050. To satisfy such demands cost-effectively by established compound semiconductor solar cell base materials, the availability of resources from known economic reserves will be crucial, except that new routes of material savings need to be identified. In order to meet this challenge by cost-effective thin film photovoltaic, various technical approaches have to be considered and will be discussed in this presentation using Cu(In,Ga)(Se,S)₂ technology, also named CIS technology, for example: Improving power conversion energy by advanced chemical material engineering and/or electrical device engineering applied to established macroscopic planar, single solar cell device configuration; reducing CIS film thickness without performance losses by means of advanced approaches in optical device engineering such as by implementation of micro- and nanostructures, plasmonics or photonics in single solar cell device configurations; improving power conversion energy by novel tandem photovoltaic concepts, consisting of monolithically stacked solar cells based on two different absorber materials, and furthermore; improving power conversion energy as well as saving material consumption by concentrating photovoltaics, particularly novel designs of micro-concentrator photovoltaic concepts. Finally, a smart combination of the different approaches could be most effective. Thus, in addition to long-term stability of device performance, looking for appropriate compatible fabrication technologies will be necessary.

Biography

Martha Ch Lux-Steiner completed her Graduation at Institute of Biomedical-Technology, and PhD at ETH Zurich, Switzerland. She completed her Post-doctoral Degree in Habilitation and Optoelectronics at University of Konstanz, Germany, where she worked from 1980 to 1995. In 1991, she was appointed as a Research Fellow in Department of Electrical Engineering at Princeton University, USA. She has been a Full Professor at Free University of Berlin and Head of the Institute for Heterogeneous Material Systems at Helmholtz-Zentrum Berlin, Germany since 1995. She is also a member of various international and national advisory boards and committees and was awarded several prizes.

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