Contribution ID: **27** Type: **Oral Presentations**

Optimization of Renewable Energy Processes: Projects at the Synchrotron Radiation Facility PETRA III

Tuesday, 17 November 2015 11:10 (30 minutes)

Today's societies are eminently depending on the access to permanently available energy sources. However, more than 80% of the worldwide energy consumption is based on ultimately finite resources such as fossil fuels and nuclear power. Therefore, huge efforts are taken to provide the growing world population with permanent sustainable energy.

One of these energy sources is the sunlight which could deliver 10,000 times the power at present consumed by mankind. However, to efficiently harvest and store the energy from sunlight on large scales is still a great challenge as the technology of efficient and cost-effective solar cell based power plants is still not developed. Furthermore, the sun power has to be buffered to bridge the sunless gap during the night, and new and optimized battery technologies with high duty cycles is required.

It will be presented how 3rd generation synchrotron radiation sources such as PETRA III in Hamburg, Germany, uniquely contribute to the engineering process of deveoping new solar cells and batteries. With their capability for in-situ investigations of energy generating and storing systems on microscopic and atomic scales, synchrotron radiation based measurements such as element specific imagaging and tomography of highest resolution are crucial for the advancements in energy technology.

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Session Classification: Scientific Talks

Track Classification: Main