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SEMINAR SERIES

HIGHLIGHTS IN ENERGY RESEARCH

26. 04. 2018, 10:30 – 11:30, ENERGYPOLIS Sion, 4th floor, ZEUZIER room

Modelling, Experimentation and Scaling of Solar Fuel Processing Devices

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Solar radiation is the most abundant energy source available but it is distributed and intermittent, thereby necessitating its storage via conversion to a fuel (e.g. hydrogen or carbohydrates) for practical use. Solar thermo-chemical and photo-electro-chemical approaches (and combinations thereof) provide viable routes for the direct synthesis of solar fuels. Both approaches involve complex interactions between multi-mode heat transfer, multiphase flow, charge transfer, and chemical reaction.

First, I focus on cost competitive photo-electrochemical (PEC) devices. I review the development of our PEC model framework[1]. I then show how we used this model to design and implement a PEC device with a solar-to-fuel efficiency of 17%. Finally, I discuss ongoing scaling approaches by our lab for the design, implementation, and testing of these devices, in order to bridge the gap between research and practical application.

Second, I discuss our work on high-temperature electrolysis for the production of fuels. I review the techno-economic modeling, as well as receiver-reactor modeling[2] followed by experimental demonstration of the approach and an outlook on a more integrated solar-driven thermo-electrochemical hydrogen generation.

I finish by comparing the various solar fuel generation pathways and compare the challenges and future pathways of the different, complementing processing routes.

References:

1. S. Y. Tembhurne and S. Haussener, *Journal of The Electrochemical Society*, 163:H1008-H1018, 2016.
2. M. Lin, J. Reinhold, N. Monnerie, and S. Haussener, Applied Energy, 216: 761-776, 2018.

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Sophia Haussener is an Assistant Professor heading the Laboratory of Renewable Energy Science and Engineering at EPFL. Her research interests include: thermal sciences, fluid dynamics, charge transfer, electro-magnetism, and thermo/electro/photochemistry in complex multi-phase media on multiple scales. She received her PhD (2010) in Mechanical Engineering from ETH Zurich, and was a postdoctoral researcher at the Joint Center of Artificial Photosynthesis (JCAP) and the Lawrence Berkeley National Laboratory. She is a deputy leader in the Swiss Competence Center for Energy Research (SCCER) on energy storage, serves as an Associate Editor for the Journal of Renewable and Sustainable Energy, and acts as a Member of the Scientific Advisory Council of the Helmholtz Zentrum.