UP 1: Sustainability: Challenges and Solutions (joint session UP/CPP/SOE)

Accompanying session to Symposium SYSC

Time: Monday 9:30–10:30 Location: MER/0002

UP 1.1 Mon 9:30 MER/0002

Making a university climate neutral: First experiences from implementing a Climate Protection Strategy at the University of Greifswald — •Christoph G. Hoffmann, Tiemo Timmermann, and Christian von Savigny — University of Greifswald, Greifswald, Germany

With a resolution of its Academic Senate, the University of Greifswald has in 2021 set the goal to achieve climate neutrality by the end of the decade.

While the aim of achieving climate neutrality within a few years is expectedly ambitious, a university as a bigger research institution has also a unique combination of knowledge to achieve it. This has already led to synergies from which particularly the teaching in the environmental subjects can benefit due to "home-made" practical experiences. This makes the whole University a living lab, in which the opportunities but also challenges of necessary transformations can be explored in an assessable setting.

Therefore, also the environmental physics group aims at contributing to and benefiting from this process. While our group is originally focused on basic atmospheric research, we cover a broader range of environmental physics topics in teaching, which overlap with the needs of the transformation process.

In this talk, we will give a short overview of the Climate Protection strategy of the University of Greifswald before we show some examples from our own work regarding the energy consumption of buildings.

UP 1.2 Mon 9:45 MER/0002

Life Cycle Assessment practices for PV technologies: systematic literature review — •Zeena Patel — Technische Universität Ilmenau

In response to the growing importance of sustainability in solar energy development, this study addresses critical gaps in the application of Life Cycle Assessment (LCA) to photovoltaic (PV) technologies. A systematic review of 48 recent LCA studies across first-, second-, and third-generation PV systems was conducted to evaluate current practices, identify methodological inconsistencies, and highlight emerging trends. Despite increasing research interest and technological diversification, substantial variability exists in the definition of functional units, system boundaries, and impact categories, which hinders comparability and reproducibility. The widespread reliance on secondary databases and the limited use of primary, site-specific data further constrains the accuracy of environmental impact assessments. Additionally, the underutilization of Life Cycle Costing (LCC) and inconsistent application of sensitivity analyses reveal significant gaps in comprehensive sustainability evaluation. To advance the field, this study proposes standardization of LCA methodologies, improved data transparency, and expansion of impact categories beyond global warming potential to include toxicity and resource depletion. These measures are essential for enhancing the robustness, reliability, and policy relevance of PV LCA studies, thereby supporting sustainable innovation and deployment in the solar energy sector.

UP 1.3 Mon 10:00 MER/0002

Electrochemical Modeling of SOFCs with Emphasis on Microkinetic and Anode Overpotential — •Iram Gul[1], Gabriela Soffiati[2], and Thiago Lopes[3] — [1]Research Center for Greenhouse Gas Innovation, University of São Paulo (USP), 05508-030, São Paulo * SP, Brazil — [2]Institute of Physics (IFUSP), University of São Paulo, Universidade, R. do Matão, 1371 - Butantã, São Paulo - SP, 05508-090 — [3]Research Center for Greenhouse Gas Innovation, University of São Paulo (USP), 05508-030, São Paulo * SP, Brazil

This study investigates Solid Oxide Fuel Cells (SOFCs) using a CO/H fuel mixture, focusing on thermodynamics, mass transport, and electrochemical kinetics. Thermodynamic properties such as heat capacity, enthalpy, entropy, and Gibbs free energy were analyzed across 600-800°C using MATLAB simulations. The Dusty Gas Model (DGM) revealed key mass transport behaviors in the anode, while Density Functional Theory (DFT) using VASP provided insights into surface reaction mechanisms. A microkinetic model examined the impact of anode overpotential on reaction kinetics and cell performance. Results show that higher temperatures improve mass transport and reduce Ohmic losses but slightly decrease the thermodynamic driving force. This multi-scale model enhances our understanding of SOFC behavior and offers a basis for improving fuel cell efficiency and material performance.

UP 1.4 Mon 10:15 MER/0002

Thermal stability of ceria-zirconia oxides(CeZrO4) nanoparticles using combustion synthesis for the CO oxidation and NOx reduction — •Hamza Mohamed — IMMM, UMRS 6283 CNRS, Le Mans Université, Bd O. Messiaen, 72085 Le Mans Cedex 09, France

The study presents a green synthesis approach for fabricating ceria-zirconia oxide nanoparticles (CeZrO4 NPs) using the solution combustion synthesis method. The synthesized CeZrO4 nanoparticles were characterized using various sophisticated instruments and methods to determine their detailed properties. The UV-Vis spectra showed a characteristic absorbance peak at 242 nm and a band gap (Eg) of 3.05 eV. Simultaneously, Fourier transform infrared spectra of CeZrO4 NPs displayed bands at 418 cm-1, 991 cm-1, 1382 cm-1, 1658 cm-1, 2306 cm-1, 3288 cm-1, and 3643 cm-1, which indicates the presence of phytochemicals that facilitate the reduction and stabilization of CeZrO4 NPs. The major peaks for cubic CeZrO4 NPs were obtained with a crystalline size of 9.6 nm by X-ray diffraction. The microscopic analyses revealed irregular, ovoid, and aggregated morphologies with sizes ranging from 3 to 10 nm. The XPS analysis revealed the existence of Ce3d, Zr3d, C1s, and O1s states with their corresponding atomic percentages. Therefore, this investigation focuses on synthesizing catalysts that demonstrate both thermal stability and high catalytic activity for the oxidation of CO and the reduction of NOx.