Graduate School Event

Thesis Defense: Oxygen and Sulfur Redox: Conversion Kinetics and Phase Equilibria

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Host: Johann Danzl

Oxygen (O) and sulfur (S) redox reactions are at the core of energy storage and biological systems. Being one of the light, cheap, abundant and most versatile redox active elements, the O and S redox chemistry is complex, and the practical realization of energy storage systems utilizing these redox systems is still very far. For O redox, the oxygen evolution from superoxide is a critical aspect, and the factors that govern the formation of triplet ($^3O_2$) and harmful singlet ($^1O_2$) oxygen are unclear. My project on O redox began by setting up a spectroscopic tool to detect singlet oxygen. Then I explored the governing factors for its formation in both aqueous and non-aqueous solutions through heterogeneous electron transfer and disproportionation and found out that the release of triplet or singlet oxygen is governed by individual Marcus normal and inverted region behaviour. For S redox in non-aqueous media in the context of the Li-S battery, the understanding of the intermediate sulfur reduction species, known as polysulfides, is incomplete. In the Li-S battery, S_8 (the most oxidized form) is converted to Li_2S (the most reduced form) in multiple steps, via first long-chain polysulfides Li_2S_x ($6 < x < 8$), short-chain LiPSs ($x < 6$) and finally solid Li_2S. However, the question of which polysulfides coexist at any state-of-charge, how they are interconverted, and what the rate and potential limiting steps are has been entirely open and equally, the solubility of shorter chain LiPSs are unknown. My PhD project on S redox explores accessing individual polysulfides through different ways to understand their equilibria in the solution and solid phase and the conversion dynamics. The results from O and S redox afford detailed insights into kinetics, thermodynamics, and reaction mechanisms, allowing them to be influenced in an informed way.

Friday, September 19, 2025 09:00am - 10:00am

Office Bldg West / Ground floor / Heinzel Seminar Room (I21.EG.101) and Zoom

This invitation is valid as a ticket for the ISTA Shuttle from and to Heiligenstadt Station. Please find a schedule of the ISTA Shuttle on our webpage: https://ista.ac.at/en/campus/how-to-get-here/ The ISTA Shuttle bus is marked ISTA Shuttle (#142) and has the Institute Logo printed on the side.