Fakultät für Naturwissenschaften

Institut für Chemie

lädt ein

gemeinsam mit der Gesellschaft Deutscher Chemiker zum

Vortrag

von Herrn

Dr. Stefan Topolovec
Institute of Materials Physics
Graz University of Technology

“Combining magnetometry with electrochemistry for operando studies of battery materials and magneto-ionic effects”

am: Donnerstag, 16.10.2025

um: 09:30 Uhr

wo: im Raum A12.232

Gäste sind herzlich willkommen!

TECHNISCHE UNIVERSITÄT
IN DER KULTURHAUPTSTADT EUROPAS
CHEMNITZ

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Fakultät für Naturwissenschaften

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Combining magnetometry with electrochemistry for operando studies of battery materials and magneto-ionic effects

Although, "At first sight, magnetism and electrochemistry seem an odd couple'[1], the combination of these two disciplines is relevant across a wide range of research fields. These include two application-relevant areas that have attracted considerable attention in recent years years: (i) the usage of magnetic characterization techniques to study processes in battery materials[2], and (ii) the field of magneto-ionics, where electrochemical processes are used to switch or control the magnetic properties of a material[3]. In this talk, I will provide an overview of our recent contributions to these fields.

In the first part, I will present our approach of using operando SQUID magnetometry to continuously monitor the redox activity of battery electrodes. The working principle and capabilities of this technique will be demonstrated based on results we obtained for $LiNi_{0.33}Mn_{0.33}Co_{0.33}O_2$ cathodes[4], where our measurements have revealed that, upon delithiation, Ni changes its oxidation state stepwise from Ni^{2+} to Ni^{3+} and then to Ni^{4+}, and that the partial Co oxidation setting in at higher voltages is associated with irreversible capacity losses. Then, recent results for sodium vanadium titanium phosphate (NVTP) electrodes will be presented, where we could show that the same charge compensation processes occur in both organic and aqueous electrolytes[5].

The second part of my talk will focus on magneto-ionic effects in nanoporous Pd-Co alloy samples prepared by dealloying. So far, magneto-ionic effects in Pd-Co systems have primarily been observed using hydrogen ions[6,7]. Here, I will demonstrate that, for Pd-Co alloys with relatively high Co content, oxygen-based processes are also capable of inducing substantial changes of the magnetization.

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[3] K. Leistner, Curr. Opin. Electrochem. 25 (2021) 100636.
[4] G. Klinser et al., Appl. Phys. Lett. 109 (2016) 213901.
[5] B. Huemer et al., J. Mater. Chem. A 12 (2025) 2934.
[6] M. Gößler et al., Small 15 (2019) 1904523.
[7] A.E. Kossak et al., Adv. Funct. Mater. 34 (2024) 2403858.

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