

# Albert K. Engstfeld

Ulm University, Institute of Surface Chemistry and Catalysis,  
Ulm/Germany

Tuesday, 3<sup>rd</sup> December 2019, 16:00 s.t.

TU Wien, Institut für Angewandte Physik, E134  
1040 Wien, Wiedner Hauptstraße 8-10  
Yellow Tower „B“, 5<sup>th</sup> floor, SEM.R. DB gelb 05 B



## Site-specific electrochemical properties of (modified) single crystal electrodes

Over the last decades, fundamental research on the electrochemical/-catalytic properties of low index single crystals has played an important role for the understanding and improvement of industrially relevant and more complex (electro-)catalyst materials. One of the fundamental questions deals with the elucidation of the activity of specific sites on a catalyst material, which should ultimately reveal the most active site. In this context, mono- or bimetallic single crystal electrodes provide suitable substrates, since the number of different sites on their surfaces is in general limited. Changing the number of these sites systematically allows, finally allows for a direct correlation between electrochemical/-catalytic properties and these sites. A rather versatile experimental approach for such fundamental studies is the combination of electrochemical techniques with an ultrahigh vacuum set-up.<sup>[1]</sup>

Following this approach, we use our UHV system primarily for sample preparation, nanostructure formation and structural characterization by STM under UHV conditions, both before and after, the electrochemical characterization.<sup>[2,3]</sup> I first discuss the electrochemical properties of monometallic (Pt, Ru, Cu) single crystal electrodes. In principle these electrodes should serve as a benchmark for comparison between different research groups, but I will show that this is mostly only possible in the case of Pt. In a second step, I will discuss the influence of step sites on Pt(111) electrodes on the electrochemical CO oxidation, where the “active” sites can be selectively blocked by Au adatoms. Finally, I discuss the influence of bimetallic PtRu sites on the CO and MeOH electro-oxidation. In contrast to theoretical predictions and reports from more complex catalyst materials, we observed an unexpected low electro-catalytic MeOH oxidation activity. Modifying and changing the active sites on these systems reveals that the commonly proposed and widely accepted bifunctional mechanism presumably does not play a significant role. Other reasons for the unexpected observations will be discussed.

[1] Schnaidt, Beckord, Engstfeld, Klein, Brimaud, Behm, *PCCP*, **19** (2017) 4166

[2] Engstfeld, Brimaud, Behm, *AngewChemIntEd.*, **53** (2014) 12936

[3] Engstfeld, Klein, Brimaud, Behm, *SurfSci*, **631** (2015) 248

All interested colleagues are welcome to this seminar lecture (45 min. presentation followed by discussion).

Friedrich Aumayr  
(LVA-Leiter)

Ulrike Diebold  
(Seminar Chair)