Complex forms of organization are often the result of nonlinear interactions between their basic building blocks. As a consequence, the system’s properties cannot be explained by extrapolating knowledge about the molecular structure of the components, which build up the system. Rather, in addition, information about their mutual interactions is required. Examples for such organization forms range from physical systems, such as the formation of filament clusters in gas discharge tubes or spiral galaxies, over materials science, where, e.g., the spontaneous ordering of nano-scale layers during the co-deposition of different metals is observed, to chemical and biochemical systems, where pattern formation during the heterogeneously catalyzed CO oxidation or glycolytic oscillations, respectively, are prominent examples.

Also during electrochemical reactions, pattern formation is a widespread phenomenon. However, the experimental study of many of these patterns has been hampered by missing suitable in situ techniques that allow the detection of species adsorbed on the electrode surface without interfering with the reaction dynamics. We demonstrate that infrared absorption spectroscopy in the attenuated total reflection configuration can be utilized to obtain spatially resolved information on the metal-liquid interface under reaction conditions. The systems studied are the electrooxidation of CO and of H₂-CO mixtures on Pt electrodes. Both systems are among the most important electrocatalytic reactions both from a fundamental and applied point of view. I will discuss the mechanisms leading to the dynamic instabilities and highlight the differences between the two systems from a nonlinear dynamic point of view.

Universitätshauptgebäude, Hörsaal 3,
Donnerstag, den 10. Dezember 2009 um 17 Uhr c.t.
gez. Prof. Dr. Thomas Koop, Prof. Dr. Jochen Mattay, Prof. Norbert Sewald