Berlin Center for Studies of Complex Chemical Systems

Fritz-Haber-Institut der Max-Planck-Gesellschaft, Humboldt-Universität, Max-Delbrück-Centrum für Molekulare Medizin, Otto-von-Guericke-Universität Magdeburg, Physikalisch-Technische Bundesanstalt, Technische Universität Berlin, Universität Potsdam.

Seminar

Complex Nonlinear Processes in Chemistry and Biology

Honorary Chairman: G. Ertl.
Organizers: M. Bär, C. Beta, H. Engel, M. Falcke, M. J. B. Hauser, J. Kurths, A. S. Mikhailov, P. Plath, L. Schimansky-Geier, and H. Stark.

Friday, 9th May, 2014, 16:00 s.t.
Address: Richard-Willstätter-Haus, Faradayweg 10, 14195 Berlin, U-Bahnhof Thielplatz (U3).

Prof. Dr. Katharina Krischer

Physik-Department, Technische Universität München

Clusters and chimeras during silicon electrodissolution: experiments and theory

The oscillatory photoelectrodissolution of n-doped silicon exhibits a rich variety of patterns forming in the oxide-layer thickness. We investigate the spatio-temporal behavior of the electrode in the oscillatory regime using ellipsometric imaging. A photoactivation of the electrode is required and a limited illumination intensity acts as the essential spatial coupling between the points on the electrode surface. With this nonlinear coupling spontaneous pattern formation is usually found whereas otherwise the oscillations are spatially uniform. The patterns found are remarkably versatile ranging from phase cluster patterns over modulated cluster patterns, where the phase shift between different regions is not simply given by pi, to chimera states. Furthermore, also coherent substructuring of one of the two cluster domains is observed.

Introducing a nonlinear global coupling in the complex Ginzburg-Landau equation allows us to identify this nonlinear coupling as the essential ingredient to describe the patterns found in the experiments. The nonlinear global coupling is designed in such a way, as to capture an important, experimentally observed feature: the spatially averaged oxide-layer thickness performs nearly harmonic oscillations. Simulations of this modified complex Ginzburg-Landau equation capture the experimental dynamics very well.

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