Non-equilibrium deNOx reaction: Transition from mono to bimodal periodic oscillations

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Field Emission Microscopy (FEM) has been proven to be an efficient technique to observe catalytic reactions at the nanoscale [1,2]. The surface dynamics can be monitored in real time, via the brightness signal which reflects the local surface composition. Using this technique, the catalytic reduction of NO_2 is investigated on a single platinum catalytic grain conditioned as a tip. Self-sustained periodic oscillations of water production are observed and characterized by means of correlation analyses [3] and attractor reconstruction from the time series. A transition to more complex oscillations is observed and characterized by the recurrence of a double peak in the brightness signal. Analyzing the reconstructed attractor, and extracting Poincaré and next maximum maps from the time series, we show that the emergence of this second peak is due to a transition of the system from mono to bimodal periodic oscillations.

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