第124回触媒化学研究センター談話会

演　題：Heterogeneous Catalysis, chaos, oscillations and its golden future

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日　時：２００２年４月１８日（木）
13：30−15：30

場　所：北海道大学ファカルティハウス
エンレイソウ第一会議室（２階）

要　旨：

In this lecture the three main activities of my research group will be introduced and discussed.

1 Non-linear processes on surfaces such as chaotic and oscillatory behaviour

Objective: To understand the mechanism of oscillatory behaviour and to understand the specific differences in behaviour of various noble metal surfaces.

Results: Oscillations in rate and selectivity were studied for the NO_x (x=1 and ½) + hydrogen reactions over various Rh, Pt and Ir surfaces. The nature of oscillations, the experimental conditions at which oscillations are observed and the mechanisms are very different for the three metals. Lateral interactions in the adlayer are of crucial importance for simulation of the experimental results [1].

2. Multicomponent catalysts consisting of noble metals and transition metal oxides (MO)

Objective: a) To develop catalysts active and selective at low temperatures.

b) To understand the mechanism of catalysis by gold and the specific role of the transition metal oxide.

Results: Multicomponent catalysts consisting of Pt and a transition metal oxide (MO) have a superior activity in low temperature oxidation and reduction of nitrogen oxides to N_2. Gold is usually considered as a non-interesting metal for catalysis. However, recent results may suggest that there may be 'a golden future' for Au-based catalysts [2]. We found that Au(MO) catalysts are very active in NO_x reduction, oxidation of hydrocarbons and in selective oxidation of CO in excess of hydrogen [3].

3. Imaging of surfaces and catalytic reactions by STM, FEM and FIM

Objective: To image the active site.

Results: Spatiotemporal processes have been imaged with almost atomic resolution during NO_x reduction reactions on Rh and Ir surfaces. We have shown that alloy surfaces can be imaged by STM with atomic resolution and with identification of the two component atoms. CO oxidation on gold has been studied by field ion/electron microscopy and the active sites/species have been imaged [4].

[1] C.A. de Wolf, B.E. Nieuwenhuys, Catal.Today 70 (2001) 287.
[2] M. Haruta, Catal.Today 36 (1997) 153.
[3] R.J.H. Grisel, B.E. Nieuwenhuys, J.Catal. 199 (2001) 48.
[4] T. Bär, T. Visart de Bocarmé, B.E. Nieuwenhuys, N. Kruse, Catal.Lett. 74 (2001) 127.

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