

# XPS-Mapping of a Membrane Reactor Surface: Vanadium Oxidation State Variations

Y. Suchorski<sup>a</sup>, L. Rihko-Struckmann<sup>b</sup>, Y. Ye<sup>b</sup>, K. Sundmacher<sup>b</sup>, H. Weiss<sup>a</sup>

<sup>a</sup> *Chemisches Institut, Otto-von-Guericke-Universität Magdeburg, Universitätsplatz 2, D-39106 Magdeburg, Germany*

<sup>b</sup> *Max-Planck-Institut für Dynamik komplexer technischer Systeme, Sandtorstr.1, D-39106 Magdeburg, Germany*

Bulk vanadium phosphorus oxides (VPOs) are exceptional catalysts which are successfully used for the oxidation of butane to maleic anhydride. Recently, the feasibility of butane oxidation in an electrochemical membrane reactor (EMR) using a VPO catalyst layer on a tubular anodic electrode has been reported [1]. The characterization of the working catalyst surface, especially of the distribution of the vanadium oxidation state in the VPO layer is essential for the understanding of its catalytic operation in the EMR. Position-resolved XPS measurements have been performed in the "fast transfer XPS-mode" [2], and allowed mapping of the V oxidation state in the VPO layer along the reaction coordinate. Additionally, the XPS measurements permitted to determine the radial and azimuthal distributions of V<sup>5+</sup> and V<sup>4+</sup> species in the tubular VPO layer. Both the axial (along the reaction coordinate) as well as the radial (across the VPO layer) distributions show significant variations of the V oxidation state, whereas the negligible changes of the latter were observed when its azimuthal dependency was studied. The results are explained on the basis of the EMR configuration and geometry of reactant flows.

[1] Y. Ye, L. Rihko-Struckmann, B. Munder and K. Sundmacher, *Appl. Catal.* 285 (2005) 86.

[2] Y. Suchorski, L. Rihko-Struckmann, F. Klose, Y. Ye, M. Alandjiyska, K. Sundmacher and H. Weiss, *Appl. Surf. Sci.*, 2005, in press.

## Ostwald ripening of Nb(110) step bunches: an in-situ low-energy electron microscopy study

S. Kodambaka<sup>a</sup>, W. Świech<sup>a</sup>, M. Ondrejcek<sup>a,b</sup>, I. Petrov<sup>a,b</sup>, J.E. Greene<sup>a,b</sup> and C.P. Flynn<sup>a,b</sup>

<sup>a</sup> *Frederick Seitz Materials Research Laboratory and Department of Materials Science and Engineering, University of Illinois at Urbana-Champaign, 104 South Goodwin Ave., Urbana, IL 61801, USA;* <sup>b</sup> *Department of Physics, University of Illinois at Urbana-Champaign, 1110 West Green St., Urbana, IL 61801, USA*

We used in-situ low-energy electron microscopy to study coarsening/decay kinetics of islands bounded by step bunches during annealing of three-dimensional (3D) Nb(110) mounds at temperatures between 1300 and 1475 K. At each temperature, we observe dissolution of the topmost islands and a corresponding growth of the bottom layers, indicating that mass is conserved locally. We find that areas of islands decrease non-linearly with time, regardless of the number of steps in the bunch, and consistent with the diffusion-limited decay kinetics. With increasing temperature, the number of steps in the bunch decreases indicative of increasing repulsive step-step interactions.

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