

Mon-OXD-06: The oxidation behavior of Ce-5wt.%La alloy at room temperature and low oxygen pressure

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Lanthanum and Cerium are the first two and the most reactive members of the lanthanide series. In particular, Cerium exhibits a variety of interesting phenomena under various conditions, those phenomena occur because the energy of the inner 4f level is nearly the same as those of the outer 5d and 6s levels, and only small amounts of energy is required to change the relative occupancy of the electronic levels giving rise to a variable electronic structure. Because the 4f levels are very close to that of 5d and 6s, cerium is quite sensitive to external influence such as temperature, pressure and chemical environment. In this present paper, Ce-5wt.%La alloy was made, and the crystal structure of this alloy was investigated by XRD technique. Auger Electron Spectroscopy has also been used to characterize the initial oxidation of Ce-5wt.%La alloy in an oxygen atmosphere at low pressure (10^{-6} Pa) and room temperature after the surface was cleaned by Ar⁺-ion bombardment. It is concluded from our work that exposure of clean Ce-5wt.%La to oxygen causes the appearance and development of six new Auger peaks at 97eV, 105eV, 622eV, 634eV, 662eV and 676eV, and the peaks at 662eV and 676eV steadily grow during oxidation of this alloy. Upon oxygen exposure less than 100L, the oxidation film growth follows a logarithmic relationship, and a semi-protective layer of oxide forms on the surface of alloy. With further exposure of oxygen, the oxide film grown in the previous stage become thicker and the uptake of oxygen reaches saturation at oxygen exposure of 25L, and the oxide film mainly consists of Ce₂O₃ and La₂O₃.

Mon-OXD-07: Evolution of the surface oxide stoichiometry under conventional XPS conditions

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Despite of the development of *in situ* X-ray photoelectron spectroscopy (XPS) under reactive atmosphere conditions [1], XPS under standard UHV (ultra high vacuum) conditions remains the key method for the exploration of the surface composition of the catalysts. Prerequisite for a reliable interpretation of the obtained data is the stability of the sample stoichiometry during the experiments. A new apparatus with fast sample transfers (< 5 min from ambient pressure to the first XPS spectrum in UHV) renders possible the investigation of the sample stability under UHV conditions. First observations have shown a remarkable evolution of the vanadium oxidation state in different VPO and VO_x catalysts, e.g. a significant decrease of the initial V⁵⁺/V⁴⁺ ratio by a factor of at least 2 within the first 15 - 25 min of the XPS experiment in UHV [2]. In the present contribution we extend these investigations to Fe_xO_y and Ce_xO_y oxides in order to compare the reducing influence of vacuum on the stability of the different metal oxides, and attempt to correlate the contributions of surface structure and surface stoichiometry.

1. H. Bluhm, M. Hävecker, E. Kleimenov, A. Knop-Gericke, A. Liskowski, R. Schlögl, Dang Sheng Su, Topics Cat. 23 (2003) 9.

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