Hamburg Workshop of Synchrotron Radiation in Chemistry
- Status and Future
Hamburg 16.-17. Sept. 2002

Study on the Thermal Decomposition of Ammonium Heptamolybdate

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Ammonium heptamolybdate tetrahydrate (AHM) is a common precursor for the production of molybdenum trioxide (MoO_3) [1]. Furthermore, it constitute the main part in the precursors for the production of MoO_3 based, mixed metal oxide catalyst. The latter, with varying composition, are used as partial oxidation catalyst for light alkanes [2]. AHM is studied sole to reduce the amount of parameter which may affect the decomposition pathway. This lead to an more unequivocal elucidation of the influence of extrinsic parameters, such as heating rate or gas phase composition. The obtained results serve as the starting point for the analysis of more complex systems. The constitution of decomposition products, which means the structure, the phase composition and the particle size, may depend on the decomposition conditions of the precursor [3]. Whereas the catalytic activity, on the other hand, may depend on the constitution. Therefore, detailed structural studies are required to elucidate the short-range and long-range structure evolution of the decomposition species to examine the main influences on the decomposition process and thus on the formed products. In this work the decomposition of AHM is studied in situ and ex situ with XRD and EXAFS. The use of this two complementary methods enables an insight in formation and constitution of phases. In situ and ex situ XRD is used to identify the phases formed and to reveal the crystallinity of the different phases on the long range order scale. The information gathered by XRD is used as a starting point for characterization of the local structure which is received by analysis of the EXAFS spectra. In addition, amorphous phase, which can not be characterized by XRD, can be analyzed by EXAFS. Further more, information about the oxidation state and phase composition are gathered by analysis of the NEXAFS part of the spectra. The decomposition products in the gas phase are simultaneously analyzed with mass-spectroscopy in both methods.

[1] Braithwaite E.R., Occurence, Extraction, Production and uses of molybdenum, in Molybdenum: An Outline of its Chemistry and Uses, Eds.: Braithwaite E.R. and Haber J., Elsevier 1994
[2] Haber J, Molybdenum Compounds in Heterogeneous Catalysis, ibid.
[3] J.-L. Li, T. Inui, *Appl. Catal. A,* 1996, *137*, 105