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STRUCTURALLY COMPLEX MOLYBDENUM OXIDE MODEL CATALYSTS FROM PREPARATIVE NANOSCIENCE

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Abstract

Molybdenum oxide based catalysts is prepared by precipitation method. The influence of preparation variables of temperature, acid concentration and molybdenum concentration on the structure of molybdenum oxide is investigated by Powder X-ray Diffraction, Raman Spectroscopy, Transmission Electron Microscopy (TEM) and Scanning Electron Microscopy (SEM). The combination of Powder XRD and Raman Spectroscopy was used to identify the phase and the structure of the fresh precipitate. TEM and SEM are applied as a supplement to get a better understanding of the structure and morphology of the molybdenum oxide obtained. The current preparation routine for MoVTeNb Oxides defect introduction is the incorporation with foreign atoms although the high chemical complexity of such systems makes understanding and control of catalyst formation extremely difficult. An alternative way is to reduce the chemical complexity by maintaining the same high structural complexity by preparing Molybdenum Oxide alone. Nanotechnology is a suitable tool for making specific oligo anions by carefully connecting MoO_6 octahedra. Four types of cation used were found to be clearly influencing the phase and structure obtained by looking at the size of the series $Li^+ < Na^+ < K^+ < NH_4^+$. Ammonium as counter-ion produced supramolecular $Mo_{36}O_{112}^{4-}$ and hexagonal MoO_3 while potassium yielded supramolecular $Mo_{36}O_{112}^{4-}$, hexagonal MoO_3, and additional phase trimolybdate. Both sodium and lithium resulted in hexagonal MoO_3 and orthorhombic MoO_3 respectively.

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List of Abbreviations

XRD	X-ray Diffraction
TEM	Transmission Electron Microscopy
SEM	Scanning Electron Microscopy
TG	Thermal Gravimetry
DSC	Differential Scanning Calorimetry
HRTEM	high resolution Transmission Electron Micrograph
SAED	Selected Area Electron Diffraction
EDX	Electron Diffraction X-ray
PSD	Position Sensitive Detector
ICSD	International Crystal Single Diffraction
PDF	Powder Diffraction File
FWHM	Full Widht at Half Maximum
NH_4^+	Ammonium
Li	Lithium
Na	Sodium
K	Potassium
MoO_3	Molybdenum Trioxide
HNO_3	Nitric Acid
AHM	Ammonium Heptamolybdate
Na_2MoO_4	Sodium Molybdate
Li_2MoO_4	Lithium Molybdate
K_2MoO_4	Potassium Molybdate
M	Molar (mol/l)