Synthesis and structural control of one-dimensional molybdenum oxide chains

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Molybdenum oxides are known to exhibit diverse crystal structures and morphologies.[1] For example, α-MoO_3, a two-dimensional sheet-like structure, has been utilized as a catalyst material and electrode material through intercalation. However, conventional α-MoO_3 faces several issues, such as a small surface area and the absence of micropores, when employed in catalytic materials. In this study, one-dimensional chain-like structures, resembling slices of a single sheet of α-MoO_3, were successfully synthesized and crystallized (**1**). X-ray crystallographic analysis revealed that **1** was crystallized in the primitive monoclinic $P2_1/c$ with the short *a*-axis and was the bundle of unique one-dimensional MoO_3 subnanofibers along the *a*-axis (Figure 1). Each fiber was composed of two edge-sharing octahedral {MoO_6} zigzag chains connected by corner-sharing Mo–O–Mo bonds, which was essentially the same structure obtained by cutting one layer of two-dimensional α-MoO_3 sheet into 8.0 Å wide strips along [001] direction. Importantly, O atoms of *N*,*N*-dimethylformamide molecules were coordinated to Mo atoms to prevent fibers from further condensation into two-dimensional structures. Inspired by this unique structure of **1**, α-MoO_3 was synthesized by calcination of **1** at different temperatures. Consequently, structural control of the material through calcination was possible, resulting in the preparation of unique oxidation catalysts with properties not present in conventional α-MoO_3.

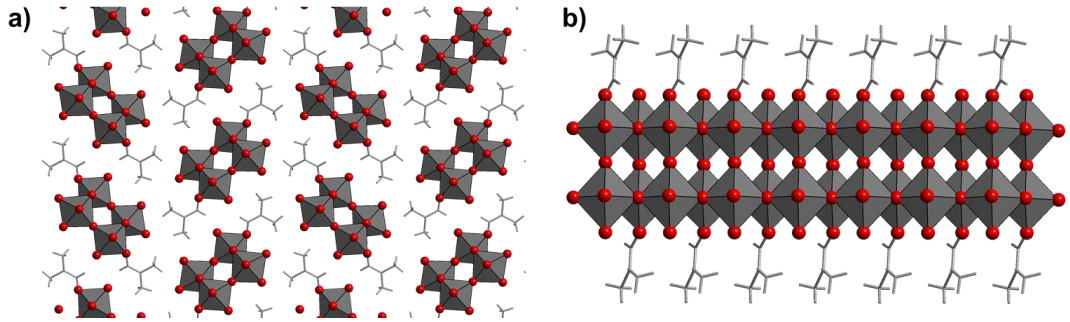

Figure 1. a) Crystal structure of **1** along *a*-axis and b) fiber structure of **1**.

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