

Studies of Processes Occuring during Alkoxide Derived V-O-W Unsupported Catalyst Formation

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ABSTRACT

The aim of this paper is to investigate the processes occurring during V-O-W unsupported-catalyst formation in order to gain the knowledge necessary to design supported catalysts. Sol-gel synthesis of V-W hydroxo-oxide hydrate (W:V=9:1) from tungsten and vanadyl isopropoxides is described. The hydrate structure is shown to be related to $\text{WO}_3 \cdot 0.33\text{H}_2\text{O}$ one. The role of vanadium in the formation of this structure is discussed. Hydrate dehydration is shown to result in the formation of V-W hydroxo-oxide isostructural with hexagonal WO_3 . Further heating of hydroxy-oxide causes a loss of hydroxy groups accompanied by formation of V-W oxide bronze isostructural with tetragonal WO_3 . Annealing the bronze in an air atmosphere results in the removal of vanadium from the bronze crystallites due to its surface segregation. The formation of the surface vanadia-like species on WO_3 -related crystallites is found to be a result of vanadium segregation. Increasing the annealing temperature causes recrystallization of the surface species. The synthesis of the V-W/ TiO_2 oxide catalyst via a mixed oxide formation in the presence of titania sols followed by surface vanadium segregation in an air containing atmosphere is proposed. The application of the knowlegde gained during investigation of the formation of the unsupported V-O-W catalyst to the discussion of the morphology of the V-O-W/ Ti_2SnO_2 (rutile) catalyst is also demonstrated.