NanoMat 2018: Bimetallic acetate complexes derived La(III)-doped TiO2 nanofibers for Claus catalysts - Ruohong Sui - University of Calgary, Canada

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Modified Titania is of great interest for industrial catalysts and photocatalysts with applications in environmental engineering. In this research, La(III) was incorporated into titanium oxoacetate complexes via a one pot sol-gel process of metal alkoxides reacting with acetic acid, evidenced by electrospray ionization mass spectrometry analysis. The resulting well-defined nanofibers were calcined to obtain 1-dimensional La-doped TiO2 materials. For comparison, lanthanum was also deposited on the surface of TiO2 nanofibers by an impregnation method. X-ray photoelectron spectroscopy analysis shows that the oxygen defect in the La-doped sample was more significant than that in the La-deposited TiO2. In addition, more interaction of lanthanum with the TiO2 matrix was observed in the nanofibers synthesized via the sol-gel method. These features of doped TiO2 nanofibers are anticipated to play a role in higher catalytic activity. In addition, both the Ladoped and deposited TiO2 nanofibrous materials exhibited excellent thermal stability. The N2-physisorption and powder x-ray diffraction characterizations show that both anatase crystallites and surface areas in the lanthanum-modified TiO2 were maintained better than the unmodified counterparts at temperatures up to 900Â°C. As a cleaner energy resource, natural gas provides about 30% energy consumption and more than 27% electricity generation in North America. However, many natural gas reservoirs contain H2S, which needs to be removed by amine scrubbing followed by a Claus process. With pending stricter emission policies and lower commodity prices, it is urgent for natural gas producers to seek more efficient Claus catalysts. In this context, lanthanum-modified TiO2 was tested as a Claus catalyst and a better performance was observed than the unmodified TiO2. We attributed the promoted catalytic activity of La-modified TiO2 to the M3+ cations, which causes oxygen defects in TiO2 and thereby increases SO2 adsorption capacity. A higher SO2 adsorption on the catalytic surface enhances both H2S and CS2 conversion. In addition, sulfate concentrations in the used catalysts were studied to explain the catalytic activities.

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