
Methanol synthesis over ZnO: A structure-sensitive reaction?

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In order to identify active sites on ZnO powdered catalysts in methanol synthesis a total of five ZnO samples with different degrees of crystallinity were characterized by means of N₂ physisorption, XRD, TEM, and EXAFS. With respect to catalysis, high-pressure methanol synthesis was performed as a test reaction. A linear area-activity relationship for the highly crystalline materials was obtained, but at high BET surface areas a strong deviation from linearity was found. The observed phenomena provide evidence for a structure-sensitivity, suggesting that a specific active site is favored for methanol formation. Based on earlier work with polycrystalline ZnO powder and with respect to the current theoretical and experimental work with ZnO single crystals, the polar ZnO faces are assumed to be highly relevant for the catalytic activity under methanol synthesis conditions.