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Impact of Zn/Cr Ratio on ZnCrOx-SAPO-34 Bifunctional Catalyst for Direct Conversion of Syngas to Light Olefins

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Abstract : Light olefins are important building blocks for chemical industry. Direct conversion of syngas to light olefins has been investigated for decades. Meanwhile, the limit for light olefins selectivity described by Anderson-Schulz-Flory (ASF) distribution model is still a great challenge to conventional Fischer-Tropsch synthesis. The emerging strategy called oxide-zeolite concept (OX-ZEO) is a promising way to get rid of this limit. ZnCrO_x was prepared by co-precipitation method and (NH₄)₂CO₃ was used as precipitant. SAPO-34 was prepared by hydrothermal synthesis, and Tetraethylammonium hydroxide (TEAOH) was used as template, while silica sol, pseudo-boehmite, and phosphoric acid were Al, Si and P source, respectively. The bifunctional catalyst was prepared by mechanical mixing of ZnCrO_x and SAPO-34. Catalytic reactions were carried out under H₂/CO=2, 380 ℃, 1 MPa and 6000 mL·g_{cat}⁻¹·h⁻¹ in a fixed-bed reactor with a quartz lining. Catalysts were characterized by XRD, N₂ adsorption-desorption, NH₃-TPD, H₂-TPR, and CO-TPD. The addition of Al as structure promoter enhances CO conversion and selectivity to light olefins. Zn/Cr ratio, which decides the active component content and chemisorption property of the catalyst, influences CO conversion and selectivity to light olefins at the same time. C₂₋₄⁼ distribution of 86% among hydrocarbons at CO conversion of 14% was reached when Zn/Cr=1.5.

Keywords : light olefins, OX-ZEO, Syngas, $ZnCrO_x$
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