Selectivity Control in Syngas Conversion to Light Olefins

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Abstract

The most challenging issue in syngas conversion to light olefins is the controlled C-C coupling without polymerization into long chain hydrocarbons and forming paraffins.[1, 2] We recently reported that coupling of partially reduced oxide surface and confined acidic zeolite pores makes it possible to tune the products towards light olefins. This is enabled by a nanocomposite with bifunctionalities, which affords two types of active sites with complementary properties.[3,4,5] The partially reduced oxide surface (ZnCrOx) activates CO and H_2, and C−C coupling is subsequently manipulated within the confined acidic pores of zeolites. Thus a selectivity of light olefins $C_2^=$-$C_4^=$ up to 80% in hydrocarbons is obtained at a single pass CO conversion of 17%. Characterization with synchrotron-based vacuum ultraviolet photoionization mass spectroscopy (SVUV-PIMS), in situ near ambient pressure X-ray photoelectron spectroscopy (XPS) implied that ketene (CH_2CO) likely plays an important role as an intermediate. These findings open up a new avenue for development of syngas-to-olefin technologies, which may allow utilization of coal- and biomass-derived syngas with a low H_2/CO ratio. We will discuss in more details about the selectivity control mechanism in the presentation.

References

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