Non-oxidative Direct Conversion of Methane to Olefins and Aromatics over Fe-based Catalysts

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The recent discovery of vast reserves of shale gas has led to extensive research on the synthesis of valuable chemicals from methane. However, most methane conversion technologies are not commercially viable due to their low carbon efficiency. Non-oxidative conversion of methane could be an alternative approach to produce light olefins and aromatics. A key challenge for direct methane conversion is the increase in maximum one-pass yields without coke formation through catalyst design and optimization of reaction parameters. In this presentation, we will discuss how to precisely control the product selectivity, including C1-C5 alkanes, C2-C5 alkenes, C2 alkynes, and (alkyl-) aromatics. By using the catalyst under optimized reaction condition, we successfully controlled the formation rate of hydrocarbon products. In particular, the catalytic system selectively converted C2 products into aromatics. Catalytic performance in several reactor models varied and we tried to elucidate the differences in reactivity to both gas phase and catalytic surface reactions.