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Strategies to Activate and Functionalize Light Alkanes

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Abstract

The wide availability of light alkanes opened new opportunities to synthesize light olefins and oxygenates, challenged only by the high dispersion of the carbon sources, requiring dedicated processes. Three different principal catalysis pathways will be used to exemplify potential and limitations: the conversion of methane to methanol, the oxidative dehydrogenation of ethane and the dehydrogenation of propane to propene, eventually followed by aromatization. For these routes it will be shown, how the atomistic understanding of the catalyst properties including an atomistic description of the active site by combining kinetics, physicochemical measurements and theory allows to drastically improve catalysts and catalytic pathways. Combining rigorous kinetics with spectroscopy allowed to relate rates to specific active sites and maximize their concentration. The potential and limitations of this fundamental approaches to improve and re-think practical catalysts will be discussed.