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Oxidative dehydrogenation of light alkanes to olefins on boron-based catalysts

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PURPOSE OF THE ABSTRACT

Catalytic conversion of light alkanes to olefins is an important way to solve the excessive dependence on petroleum resources for olefin feedstock. Oxidative dehydrogenation (ODH) of light alkanes to olefins, featured by its intrinsic exothermicity and being free of coke, is a promising alternative in the field of industrial catalysis. Metal-free boron-based catalysts have shown both great fundamental and practical value in ODH of light alkanes. In particular, boron-based catalysts show a superior selectivity toward olefins, excellent stability and atom-economy to valuable carbon-based products by minimizing CO2 emission, which are highly promising in future industrialization. This abstract summarized the design of the boron-based catalysts (such as BN, B2O3, BPO4, borosilicate zeolite, et al) and their characterization, their performance in the ODH of light alkanes, and the mechanistic issues of the ODH including the identification of the possible active sites and the exploration of the underlying mechanisms. We discussed different boron-based materials and established versatile methodologies for the investigation of active sites and reaction mechanisms. Also, we elaborated on the similarities and differences in catalytic and kinetic behaviors, and reaction mechanisms between boron-based metal-free materials. We believe our research will provide avenues for the rational design of boron-based catalysts with associated advantages and great potential applications in ODH of light alkanes.

FIGURES

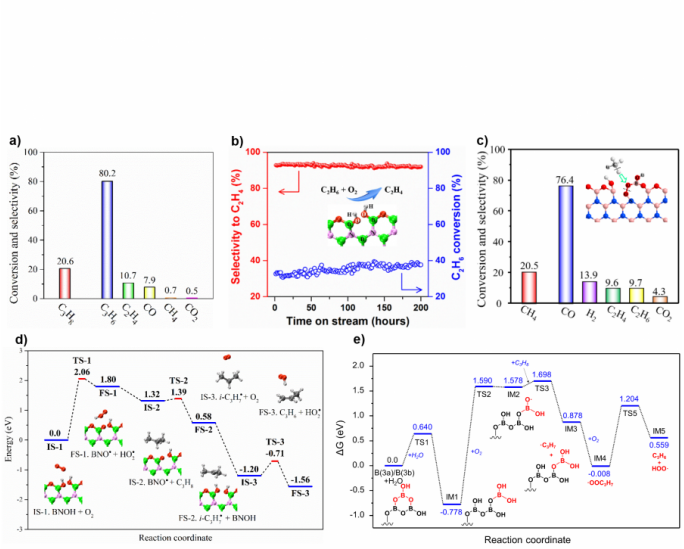

FIGURE 1

Figure 1

(a) ODH of propane over the BNOH catalyst, (b) ODH of ethane over the BNOH catalyst, (c) selective oxidation of methane over the h-BN catalyst, (d) the most probable pathway and the free energy profile of ODH propane catalyzed by BNOH from DFT calculatio

FIGURE 2

KEYWORDS

boron-based catalysts | oxidative dehydrogenation | light alkanes | olefins

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