**CO2 Assisted Ethane Oxidative Dehydrogenation Over MoOx Catalysts Supported on Reducible CeO2-TiO2**

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**ABSTRACT**

The oxidative dehydrogenation of low molecular weight alkanes, such as ethane (ODHE), has been gaining interest as a promising alternative to the direct dehydrogenation (DH) route for the production of the corresponding olefins. Modern catalytic technologies for ODHE demand a paradigm shift where rational design of materials aims for high selectivity to olefins by controlling redox properties, hampering consecutive side reactions, limiting deactivation and/or enhancing in-situ coke removal pathways1. This study will discuss the effect of dispersed active sites (MoOx species) as well as nature of the composition of a reducible support (CeO2-TiO2) on the CO2-assisted ODHE. Efforts are placed to unravel competing ethane conversion pathways by means of in-situ vibrational spectroscopies coupled with catalytic performance analysis. This work will also discuss how reactant ratio (C2H6/CO2) affects the relative catalytic behavior of different catalysts. In-situ and Operando Raman spectroscopy coupled with mass spectrometry is also utilized in a transient spectrokinetic manner in an effort to provide structure-function relationships from the perspective of controlling the redox properties of the dispersed sites.

Through in-situ Raman analysis, we find that the addition of CeO2 into the mixed support enhances the redox properties not only of the CeO2-TiO2 support but also of the distinct surface MoOx species. We also find that bridging Mo–O–Mo bonds show a more robust and stable behavior in the presence of ethane and CO2. Contrary, the terminal Mo=O features are rapidly reduced under reaction conditions and most importantly, irrespective of whether CO2 was present. After reaction conditions, we show that CO2 is able to recover both the terminal and bridging M-O signals in Raman but the recovery of all oxygen species was at a much lesser extent during reaction conditions highlighting the challenges of this system for long term stability. Careful catalytic performance analysis reveals that the deposition of MoOx on the surface of bare support shifts the dominant pathway for ethane conversion from DH to ODH2.

**KEYWORDS:** Olefins, ODH, Operando, Raman, Reducibility

**REFERENCES**

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