

## Catalytic Conversion of Methane into Benzene over CZO Promoted Mo/HZSM-5 for Methane Dehydroaromatization

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**Abstract :** The promotional effect of mixed ceria-zirconia oxides (CZO) over the Mo/HZSM-5 catalyst for methane dehydroaromatization (MDA) reaction was studied. The surface and structural properties of the synthesized catalyst were characterized using a range of spectroscopic and microscopic techniques, and the correlation between catalytic properties and its performance for MDA reaction is discussed. The impregnation of CZO solid solution on Mo/HZSM-5 was observed to give an excellent catalytic performance and improved benzene formation rate (4.5  $\mu\text{mol/gcat. s}$ ) as compared to the conventional Mo/HZSM-5 (3.1  $\mu\text{mol/gcat. s}$ ) catalyst. In addition, a significant reduction in coke formation was observed in the CZO-modified Mo/HZSM-5 catalyst. The prevailing comprehension for higher catalytic activity could be because of the redox properties of CZO deposited Mo/HZSM-5, which acts as a selective oxygen supplier and performs hydrogen combustion during the reaction, which is indirectly probed by O<sub>2</sub>-TPD and H<sub>2</sub>-TPR analysis. The selective hydrogen combustion prevents the over-oxidation of aromatic species formed during the reaction while the generated steam helps in reducing the amount of coke generated in the MDA reaction. Thus, the advantage of CZO incorporated Mo/HZSM-5 is manifested as it promotes the reaction equilibrium to shift towards the formation of benzene which is favourable for MDA reaction.

**Keywords :** Mo/HZSM-5, ceria-zirconia (CZO), in-situ combustion, methane dehydroaromatization

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