

A hybrid numerical approach for multi-responses optimization of process parameters and catalyst compositions in CO₂ OCM process over CaO-MnO/CeO₂ catalyst

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Abstract

A new hybrid numerical approach, using Weighted Sum of Squared Objective Functions (WSSOF) algorithm, was developed for multi-responses optimization of carbon dioxide oxidative coupling of methane (CO₂ OCM). The optimization was aimed to obtain optimal process parameters and catalyst compositions with high catalytic performances. The hybrid numerical approach combined the single-response modeling and optimization using Response Surface Methodology (RSM) and WSSOF technique of multi-responses optimization. The hybrid algorithm resulted in Pareto-optimal solutions and an additional criterion was proposed over the solutions to obtain a final unique optimal solution. The simultaneous maximum responses of C₂ selectivity and yield were obtained at the corresponding optimal independent variables. The results of the multi-response optimization could be used to facilitate in recommending the suitable operating conditions and catalyst compositions for the CO₂ OCM process.

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