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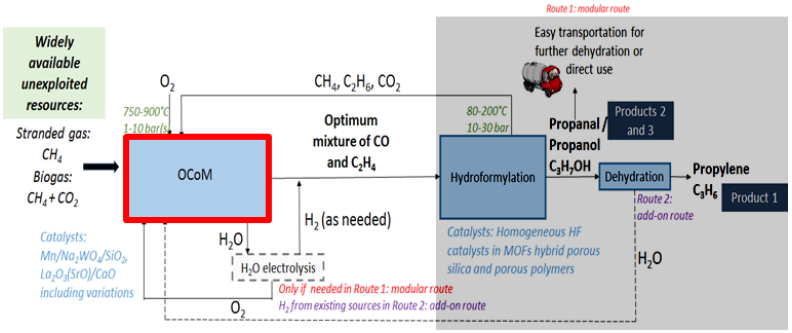
Experimental investigation into the effect of CO_2 on the Oxidative Conversion of Methane

Aim

To investigate the effect of CO_2 on oxidative conversion of methane (OCoM) and to clarify the reaction mechanism based on experiments

Justification

Being capable of converting cheap CH_4 resources into high value-added C_2 products, the oxidative coupling of methane (OCM) had gained popularity ever since its discovery[1]. However, the commercialization of OCM is hampered by the low yield of C_2 products which is caused by the inevitable oxidation of desired C_2 products to undesired CO_x. Accounting for the challenge, a novel concept of oxidative conversion of methane (OCoM) has been proposed in the framework of C123 project. Instead of striving for low CO_x formation or high C_2 yield, OCoM seeks to obtain a CO/C_2H_4 mixture for further application. As shown in the figure, OCoM involves high CO_2 containing gas (e.g. bio-gas) as feedstock and byproduct (mainly CO_2) recycling. Owing to the abundance of CO_2 in OCoM and for the purpose of achieving better carbon utilization, achieving CO_2 conversion is highly desired for OCoM.



Nevertheless, the effect of CO_2 on OCoM/OCM is unclear. Published works indicate CO_2 is highly catalyst-dependent[2], but the reaction mechanism behind the experimental observations has not been fully clarified yet. Therefore, it is necessary and important for the C123 project to understand the effect of CO_2 on OCoM/OCM as well as the reaction mechanism behind.

Program

OCM as the fundamental of OCoM needs to be thoroughly studied via literature survey. The works on the influences of CO_2 in OCM and the reaction mechanism are particularly worthy of deep investigation The experiments will be conducted in OCM conditions over reference OCM catalysts. The effect of CO_2 and its significance in OCM is expected to be observed by varying the operating conditions.

Reference

1. Gambo, Y., et al., *Recent advances and future prospect in catalysts for oxidative coupling of methane to ethylene: A review.*J. Ind. Eng. Chem, 2018. **59**: p. 218-229.
2. Taylor, R.P., *The influence of carbon dioxide on the catalytic oxidative coupling of methane over A-La_2O_3 and II-$La_2O_2CO_3$*, in *Chemical and Biological Engineering*. 1992, Iowa State University. p. 166.

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