Combine the exothermic oxidative coupling of methane and highly exothermic combustion (side) reactions with the endothermic processes of methane steam and dry reforming. Convert methane to ethylene and synthesis gas (CO and H₂) in one multifunctional reactor in an autothermal process.

INTRODUCTION
Involved reactions are shown in the scheme:
1. Oxidative coupling of methane leads to ethane and ethylene (C₂)
2. Side combustion reactions of methane and C₂ yield H₂O and CO₂
3. H₂O and CO₂ can react with remaining methane to synthesis gas (CO & H₂) via steam and dry reforming
4. Main challenge: suppress steam/dry reforming of ethane and ethylene to avoid complete reaction to synthesis gas

AIM OF THE PROJECT

OBJECTIVE
• Influence relative steam reforming rates of CH₄ and C₂H₆ by potassium addition
• Explain effect of potassium on methane/ethane competition

MIXTURE OF METHANE & ETHANE ON Pt-YSZ

Pt-YSZ without K
➢ Strong influence of components to each other: Increase in ethane concentration = less methane converted
➢ Higher concentrations: low rate for both components
K modified Pt-YSZ
➢ Methane almost unaffected by ethane addition
➢ Ethane reaction rate indicates first order behaviour
➢ Variation in methane concentration (not shown) shows similar trends: first order in methane, ethane unaffected
➢ Methane and ethane react more independently

CONCLUSIONS
• Potassium influences relative reaction rates of C₂H₆ & CH₄ on Pt/YSZ
• Competition between both components is prevented through weaker adsorption on potassium modified catalysts