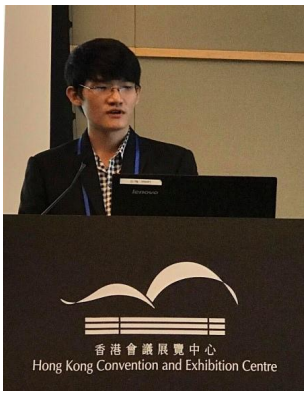
RESEARCH CATALOGUE

ENERGY TECHNOLOGY

MODELING OF TRANSPORT PHENOMENA FOR GAS-TO-LIQUID (GTL) PRODUCTION IN A NOVEL CATALYTIC MICROREACTOR



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Doctor of Philosophy in Energy Technology

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Main objectives

1. determine the kinetic information of the autothermal reforming reaction of CH_4 over a novel bimetallic Ni-Re/γ-Al_2O_3 catalyst
2. propose a new microreactor design based on the concept of embedded mixing elements for a heterogeneous reaction via the use of computational fluid dynamics (CFD)
3. study the autothermal reforming reaction of biogas and Fischer-Tropsch (FT) synthesis reaction in the optimum design of the newly proposed SAR microreactor via the use of CFD.

Main outputs / outcomes

As for the contribution to knowledge, the obtained information on the kinetics of the autothermal reforming reaction of CH_4 is among the first set of data that confirms the potential replacement of expensive Rh-based catalysts with the Ni-Re/Al_2O_3 catalyst for the reaction. A novel microreactor design was proposed which was demonstrated to enhance the autothermal reforming reaction of biogas and the Fischer-Tropsch synthesis reaction.

This study is the first to highlight the use of such a novel reactor design to achieve complete biogas autothermal reforming conversion at a higher flow velocity. The use of the novel microreactor for the FT synthesis reaction is also noted to allow complete CO utilization with higher desirable product selectivity and lower total required catalyst loading at a higher feed flow rate. Such enhancements should lead to higher synthesis gas productivity, with no need for a CO_2 separation unit. This should lead in turn to a higher economic feasibility of the whole GTL fuel conversion process.