MODIFICATION OF $Rh/Ce_{0.75}Zr_{0.25}O_2/Al_2O_3$/FeCrAl CATALYTIC MODULE: TOWARD ENHANCED EFFECTIVITY OF AROMATIC COMPOUND CONVERSION

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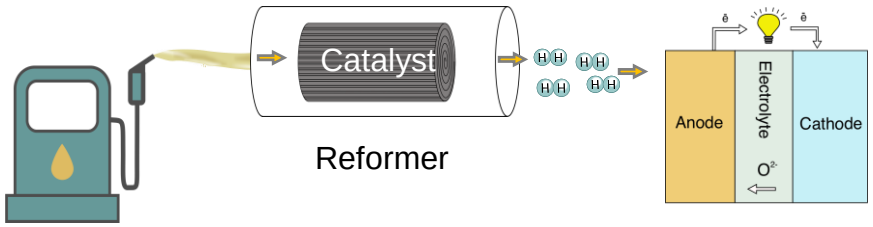
General idea

Liquid products of the oil industry - gasoline and diesel - are convenient in the case of transportation and storage. Currently, only 16 % of global hydrogen production is produced from liquid fuels. According to these facts' development of highly-efficient catalysts for reforming of diesel and gasoline to syngas is an actual and important task.



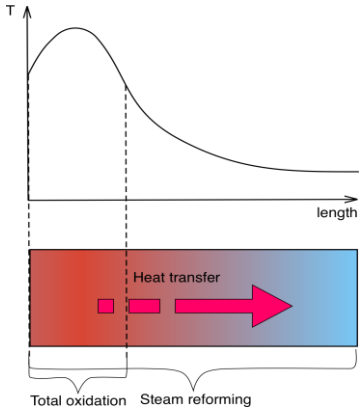
Liquid Fuel — Reformer — Fuel cell

Benefits of preliminary reforming of liquid fuel:

- ✓ Stable and continuous working process of the fuel cells;
- ✓ Comfortable storage and transportation of the fuel.

Catalysts synthesis

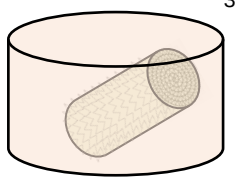
Autothermal reforming profile:



Rh- and Rh/Ni-MgO-based structured catalysts

Regeneration

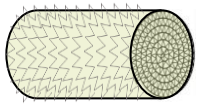
Solution of $RhCl_3$



precipitant Na_2CO_3

Ni^{2+} and Mg^{2+} solution, t ^{0}C

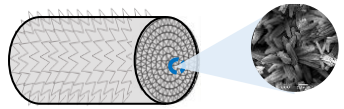
$Ni\text{-}MgO/Ce_{0.75}Zr_{0.25}O_2/Al_2O_3$/FeCrAlloy



FeCrAlloy

Metal alloys have a high thermal conductivity

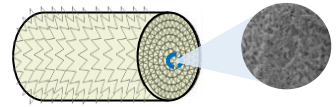
Al_2O_3/FeCrAlloy



Function of the coating of Al_2O_3 is active oxide component fixation

7-step impregnation by Ce^{3+} and Zr^{4+}, t ^{0}C

$Ce_{0.75}Zr_{0.25}O_2/Al_2O_3$/FeCrAlloy



or

Active oxide $Ce_{0.75}Zr_{0.25}O_2$:

- ✓ Active in the reaction of liquid hydrocarbons conversion to syngas;
- ✓ Resistant to carbon formation

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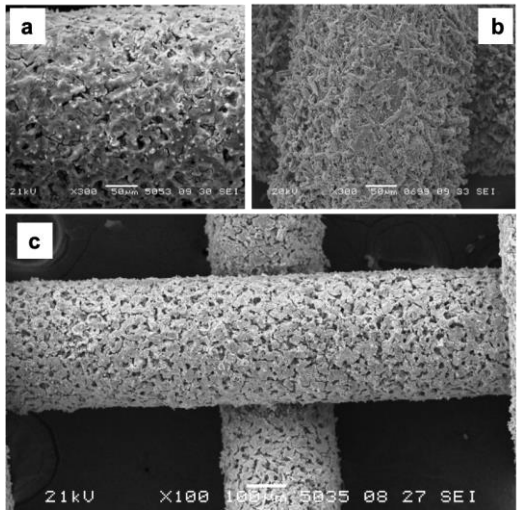
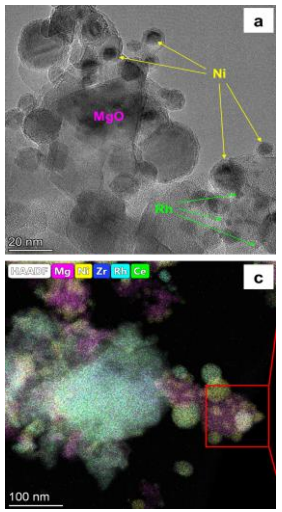
Catalysts characterization



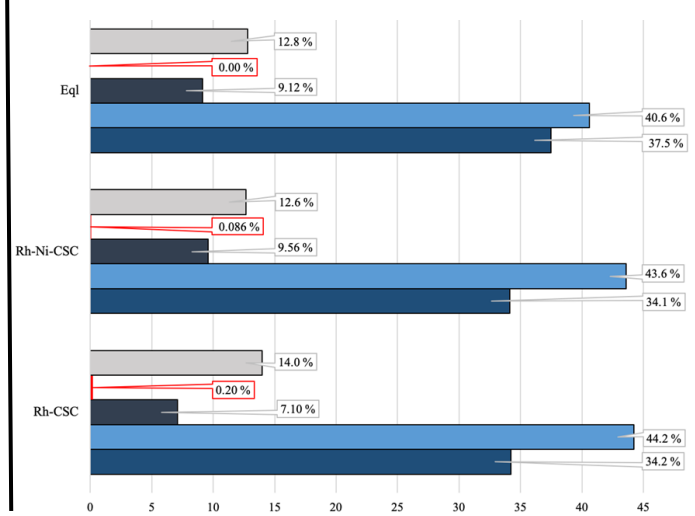
SEM images of:
(a) Rh-Ni-CSC structured catalyst at x300;
(b) Rh-CSC structured catalyst at x300;
(c) Rh-Ni-CSC structured catalyst at x100.



TEM image (a) and HAADF-STEM element distribution maps (b) for used Rh-Ni-CSC catalyst.

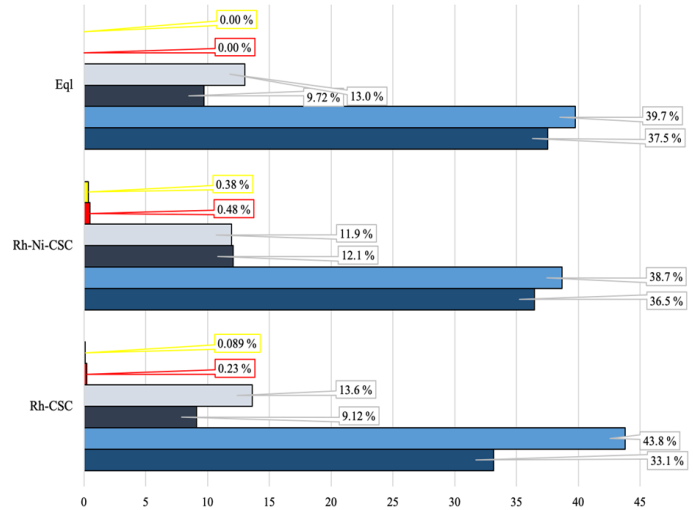
Catalytic activity measurements

Isooctane ATR:



Composition of outlet gas mixture, vol. %

Isooctane (80%) and o-xylene (20%) blend ATR:



Composition of outlet gas mixture, vol. %

CO_2 CH_4 C2+ CO N_2 H_2

Ref.: N. V. Ruban, D. I. Potemkin, V. N. Rogozhnikov, K. I. Shefer, P. V. Snytnikov, V. A. Sobyanin. Rh- and Rh–Ni–MgO-based structured catalysts for on-board syngas production via gasoline processing, International Journal of Hydrogen Energy, Available online 25 February 2021

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