

Heterogeneous Catalysis & Reaction Engineering Laboratory

(Catalysis Research Group)



**Chemical Engineering Department
King Saud University
Kingdom of Saudi Arabia**

Heterogeneous Catalysis and Reaction Engineering Lab

About us

The Laboratory of Heterogeneous Catalysis and Reaction Engineering is a part of the Department of the Chemical engineering at College of Engineering, King Saud University (Kingdom of Saudi Arabia) and its roots date back to late nineties. Established under the supervision of Prof. Dr. Anis and it has touched the pinnacles of success with developing and improvising new techniques in heterogeneous catalysis. The first fruitful contribution, from this lab, was the development of catalyst for production of acetic acid from ethane in a single step process, through project supported by SABIC. The pivotal emphasis of our research team is aimed at applying a fundamental understanding gained from lab scale experiments, together with suitable knowledge of catalysis, to meet the industrial challenges of clean energy production. A high level of commitment distinguishes it in the catalysis research arena and drives toward even deeper and advanced levels of study. It serves as a promoting platform where the best and the brightest scientists/researchers do cutting edge research to explore innovative scientific support for advancement in the domain of present and future catalysis industry.

GROUP MEMBERS

Prof. Dr. Anis Hamzah Fakeeha

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Editor-in-Chief

King Saud University Journal (Engineering Science)

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BIOGRAPHY

Prof. Anis Hamza Fakeeha is a Professor, Ex-chairman of the Chemical Engineering Department, College of Engineering, King Saud University. He is also an Editor-in-Chief, Journal of King Saud University: Engineering Science published by Elsevier. He is honored by King Abdulaziz First Class Award; Awarded Silver Medal of King Saud University for Scientific Achievement.

He has done his Master of Science in Chemical Engineering from Kansas University in 1982 and PhD from University of Oklahoma in 1986. He has published more than 110 peer reviewed research articles and holds three American patents as well. He has been involved in a number of research projects and so far he has completed successfully more than 25 national and industrial research projects. His research interests include Petrochemical Industries; Chemical Reaction Engineering and Catalysis; Energy (Conservation, Hydrogen); Electrochemical and Biochemical Engineering; Green-house gases utilization.

SHORT CV

PERSONAL DATA

Legal Name: Anis Hamzah Abdul-Qadir Fakeeha
Scientific Name: A. H. Fakeeha
Current Rank Professor, Chemical Engineering Department, King Saud University, PO Box 800, Riyadh 11421, K. Saudi Arabia.
Languages English and Arabic.
Nationality Saudi.

EDUCATION

1986 **Ph.D.** - University of Oklahoma, U.S.A.
1982 **M.S.** - University of Kansas, U.S.A.
1978 **B.S. Honors** King Saud University, Saudi Arabia.

CERTIFICATES & AWARDS

Awarded many certificates including:

- ❖ **King Abdulaziz First Class Award:** Given to Saudi Scientists Acquiring Patents Awarded by King Abdullah Bin Abdulaziz in 28th Shaban 1425H (2004G)
- ❖ **Silver Medal** of King Saud University for Scientific Achievement Awarded by Prince Salman Bin Abdulaziz 1428H (2007G).

ACADEMIC POSITIONS

2003- Present Professor, Chemical Engineering Department, King Saud University, Riyadh 11421, Saudi Arabia.
1992-2003 Associate Professor, Chemical Engineering Department, King Saud University, Riyadh 11421, Saudi Arabia.
1986-1992 Assistant Professor, Chemical Engineering Department, King Saud University, Riyadh 11421, Saudi Arabia.
1979-1986 Graduate Student & Teaching Assistant, Chemical Engineering Department, University of Oklahoma & University of Kansas, U.S.A.

ACADEMIC TEACHING CONTRIBUTION

- ❖ **CHE 239** Chemistry of Engineering Materials.
- ❖ **CHE 313** Heat Transfer Operations.
- ❖ **CHE 314** Mass Transfer Operations.
- ❖ **CHE 411** Multistage Operations.
- ❖ **CHE 511** Advance Topics in Transport Phenomena.
- ❖ **CHE 551** Selected Topics Fluidization Engineering.
- ❖ **CHE 611** Separation Processes.
- ❖ **REEN 502** Renewable Energy 2 (Wind, Hydrogen and other).

ADMINISTRATIVE POSITIONS AND PROFESSIONAL ACTIVITIES

2003-Present Editor in Chief, Journal of King Saud University (Engineering Science)
1994-present Chairman of Graduate Study Committee, KSU.
1996-1998 Chairman of the Teaching Assistant and Missioner Committee.
1989-1992 Chairman and Member of the Laboratory and Scientific Equipment Committee, KSU.
1992-1995 Chairman of Chemical Engineering Department, King Saud University.

CURRENT RESEARCH INTERESTS

1. Evaluation of Chemical and Petrochemical Industries
2. Chemical Reaction Engineering and Catalysis
3. Transport Phenomena (Mass Heat Transfer)
4. Dry reforming of methane
5. Catalytic Decomposition of Methane
6. Energy (Conservation, Hydrogen)
7. Electrochemical and Biochemical Engineering

SELECTED FUNDED PROJECTS

Served as a Principal Investigator (PI) for many projects, including:

- 2014-2016 Production of Pure Hydrogen as source of clean Energy from Thermal decomposition of methane” supported by King Abdul-Aziz city for science and Technology (KACST) (Budget 1,350, 000 SR).
- 2005-2006 Project # 19/26 , Supported by College of Engineering Research center sponsor from Sabic Grant (SR.40,025), “Effect of addition of promoters on dry reforming reaction of methane to produce synthesis gas used in petrochemical industries”.
- 2004-2005 Project # 14/25, supported by College of Engineering Research center sponsor from Sabic Grant (SR. 40,500) “Natural gas utilization: Effect of methane to carbon dioxide ratio in synthesis gas production in petrochemical industries”.
- 2003-2005 National Project Supported from the Deanship of Scientific Research Grant at KSU “Techno-economic environmental study on utilization of Saudi wheat straw” (Budget SR. 94800).
- 1991-2002 Four phases project supported by SABIC (SR. 4,861,000) developing of catalyst for production of acetic acid from ethane gas.
- 1985-1995 Hysolar Saudi-German joint project, on solar hydrogen production and utilization (mass transfer in porous electrodes and electrolysis). (Budget DM. 35,000,000).

PATENTS

1. Karim, K., Mamedov, E., Al-Hazmi, M.H., **Fakeeha, A.H.**, Soliman. M.A., Al-Zeghayer, Y.S., Al-Fatish, A.S., Al-Arif, A.A., “Catalysts methods for producing acetic acid from ethane oxidation using Mo, V, Pd and Nb based catalysts , processes of making same and methods of using same”, United states Patent 6310241 , October 30 , 2001.
2. Karim, K., Mamedov, E., Al-Hazmi, M.H., **Fakeeha, A.H.**, Soliman. M.A., Al-Zeghayer, Y.S., Al-Fatish, A.S., Al-Arif, A.A., “Catalysts for producing acetic acid from ethane oxidation , processes of making the same and methods of using the same”, United states Patent 6383977, May 7, 2002.
3. Karim, K., Mamedov, E., Al-Hazmi, M.H., **Fakeeha, A.H.**, Soliman. M.A., Al-Zeghayer, Y.S., Al-Fatish, A.S., Al-Arif, A.A., “Catalysts for producing acetic acid from ethane oxidation, processes of making same and method of using same” , United states Patent 6030920, February 29,2000.

BOOKS

Chemical Engineering Experimentation (التجارب المعملية في الهندسة الكيميائية), Kig Saud University Press (2000).

Prof. Dr. Ahmed Elhag Abasaheed

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Prof. Dr. Ahmed E. Abasaheed is currently a Professor at the Chemical Engineering Department, College of Engineering, King Saud University (1989-present). Before joining to King Saud University, he served as an Associate Professor of research at the Renewable Energy Research Institute, National Council for Research, Sudan (1978-1994). He obtained a BS honors degree from University of Khartoum, Sudan; MS degree from University of Florida, USA and a PhD degree from Auburn University, USA. He received a number of rewards from the University of Khartoum, Sudan and King Saud University, KSA. He has published more than 150 research articles in International Journals and Conferences. He is a co-inventor of three registered US patents; two registered European patents and has recently published two US (US2014/0348736A1) and EPO (EP2808079A1) patents. He has been involved in many research projects funded by SABIC, KACST and KSU. He coauthored three books in catalytic reaction engineering, bioprocesses and reactive distillation. He is a co-founder of Almoghtarbeen University in Sudan (2010). His research interests include: Chemical Reaction Engineering and Catalysis; Selective fermentation and enhancing Engineering Education.

SHORT CV

PERSONAL DATA

Legal Name: Ahmed Abasaeed Elhag Elfaki
Scientific Name: A. E. Abasaeed
Current Rank Professor, Chemical Engineering Department, KSU, Saudi Arabia.
Languages English and Arabic.
Nationality Sudanese.

EDUCATION

1987 **Ph.D.** - Auburn University, Alabama, U.S.A.
1982 **M.S.** - University of Florida, Gainesville, Florida, U.S.A.
1978 **B.S. Honors** Chemical Engineering, University of Khartoum, Sudan.

SELECTED CERTIFICATES & AWARDS

2013 Certificate of Appreciation and Gratitude from the College of Engineering, King Saud University and BAE Systems Company for "Supervising the distinguished best final year graduation project" in the department of Chemical Engineering.
2012 Awarded "Al-Masmak Distinction Plate" by the Rectorate for Graduate Studies and Scientific Research for excellence in research and registration of patents. The ceremony was honored by the presence of H.R.H. Prince Sattam Bin Abdulaziz, Governor of Riyadh.
2009 Certificate of distinguished research execution "Utilization and Processing of Dates for Production of Fruit Sugar (Fructose), Project # AT-22-94" From King Abdulaziz City for Science & Technology, Riyadh, Saudi Arabia.
1980 AETTCC - Alternative Energy Technologies Training Course Certificate, University of Florida, Gainesville, Florida, U.S.A.

OCCUPATIONS

1989- Present Chemical Engineering Department, King Saud University, Saudi Arabia.
1978-1994 Renewable Energy Research Institute, NCR, Khartoum, Sudan.
1987-1989 Assistant Professor (part-time), Chem. Eng. Dept. UK, Khartoum, Sudan.

EXPERIENCE

Teaching:

1989-Present Chemical Engineering Department, King Saud University, Saudi Arabia.
1987-1989 Chemical Engineering Department, University of Khartoum, Sudan.

Post-Graduates Supervision & Examinations:

1989-present Supervised and examined over 30 M.S. and Ph.D. graduate students.

Research:

1978-1994 Energy Research Institute (ERI), Energy Research Council (ERC), National Center for Research (NCR), Khartoum, Sudan, December.

OTHER PROFESSIONAL ACTIVITIES

2010-present Coordinator of the academic plans Unit, College of Engineering, King Saud University, Saudi Arabia.
1989-present Served at different times as a coordinator or member of many committees in the Chemical Engineering Department, King Saud University, Saudi Arabia.

SELECTED FUNDED PROJECTS (over 1 million Saudi Riyals):

- 2010-2013 Large Scale Selective Fermentation of Saudi Dates' Syrups into Fructose and Bioethanol. Sponsored by *National Plan of science and technology*, KSU, KACST. (Budget: 1997000 SR).
- 2004-2007 Utilization and Processing of Dates for Production of Fruit Sugar (Fructose), Project # AT-22-94 *Sponsored by King Abdul Aziz City for Science and Technology* (KACST), Saudi Arabia. (Budget: 1050000 SR).
- 1996-2001 Oxidative Dehydrogenation of Lower Hydrocarbons, *sponsored by SABIC R&D*, Saudi Arabia. (Budget: 2300000 SR).

CURRENT RESEARCH INTERESTS

1. Dry reforming of methane.
2. Modeling and Simulation of Chemical and Biochemical Engineering Processes.
3. Dynamic Analysis of Nonlinear Reactive Systems.
4. Production of Fructose from Dates.
5. Oxidative Dehydrogenation of Lower Alkanes.

PATENTS

1. M. A. Othman, W. M. Zahid and **A. E. Abasaheed**, "Adsorbent material, process for its preparation and use thereof", European Patent Office **EP2808079A1** (published Dec 3, 2014)
2. M. A. Othman, W. M. Zahid and **A. E. Abasaheed**, "Adsorbent material, process for its preparation and use thereof", US Patent Office **US2014/0348736A1** (Published Nov 27, 2014)
3. I. M. El Nashef, M. H. Gaily, S. M. Al-Zahrani and **A. E. Abasaheed**, "Method for Separating Fructose and Glucose", **USA Patents 7,942,972** (May 17, 2011).
4. S. M. Al-Zahrani, **A. E. Abasaheed**, N. O. Elbashir and M. Abdulwahed, "Catalysts for Production of Olefins by Oxidative Dehydrogenation and Methods of Making and Using the Same", **USA Patents 7,256,319** (August 14, 2007).
5. S. M. Al-Zahrani, **A. E. Abasaheed**, N. O. Elbashir and M. Abdulwahed, "Catalysts Systems for the Oxidative Dehydrogenation of Hydrocarbons", **USA Patents 6,541,418** (April 1, 2003).
6. S. M. Al-Zahrani, **A. E. Abasaheed**, N. O. Elbashir and M. Abdulwahed, "New Catalyst Composition for Oxidative Dehydrogenation of Hydrocarbons, e.g., Propane, to Produce Olefins, e.g., Propylene, n-Butene and/or Isobutene", European Patent Office **EP1166869** (January 2, 2002).
7. S. M. Al-Zahrani, **A. E. Abasaheed**, N. O. Elbashir and M. Abdulwahed, "Oxidative Dehydrogenation Catalyst, for Producing Olefins, Comprises Bismuth, Nickel and alumina", European Patent Office **EP1103302 A1** (May 30, 2001).

BOOKS

1. W. A. Al-Masry and **A. E. Abasaheed**, "Introductory Bioprocess Engineering", King Saud University Press, KSA (Sep. 2004).
2. **A. E. Abasaheed** and S. M. Al-Zahrani, "Fundamentals of Catalytic Reaction Engineering", Alhomaidhi Press, KSA (August 2004).
3. F. S. Al-Harhi, I. S. Almutaz and **A. E. Abasaheed**, "Modeling and Simulation of RD unit for Production of MTBE", Lambert Academic Publishing, UK (August 2011).

Dr. Ahmed S. AL-Fatesh

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**BIOGRAPHY**

Dr. Ahmed is presently an Assistant professor at Chemical Engineering Department, King Saud University, Saudi Arabia. He got his bachelor, master and doctoral degrees in Chemical Engineering from King Saud University. He earned his MS and PhD degrees in Methane reforming with carbon dioxide (dry reforming of methane). Dr. Ahmed has three USA registered patents and over 50 publications in International peer reviewed journals and conferences. He has very strong theoretical as well as experimental capabilities and he also gained first hand research experience on several state of the art catalyst characterization techniques like, surface area and porosity, X-ray diffraction, temperature programmed techniques, thermo-gravimetric analysis etc. He has been involved in a number of research projects which have special focus on catalyst development, syngas/hydrogen production as well as direct and indirect utilization of "Greenhouse gases" (CH₄ & CO₂) through reforming processes such as dry reforming, oxy reforming and catalytic decomposition of methane. Currently, his research interests include: heterogeneous catalysis, nano-material synthesis, chemical reaction engineering, petrochemical industries, dry reforming of methane and ethylene production and production of acetic acid.

SHORT CV

PERSONAL DATA

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Scientific Name: A. S. Al-Fatesh
Current Rank Assistant Professor, Chemical Engineering Department, King Saud University, PO Box 800, Riyadh 11421, K. Saudi Arabia.
Languages English and Arabic.
Nationality Yemeni.

EDUCATION

2010 **Ph.D.** - King Saud University, KSA
2003 **M.S.** - King Saud University, KSA
1995 **B.S. Honors** King Saud University, KSA

ACADEMIC POSITIONS

2010- Present Assistant Professor, Chemical Engineering Department, King Saud University, Riyadh, Saudi Arabia.
1994-2009 Research assistant, Chemical Engineering Department, College of, Engineering, King Saud University, Riyadh, Saudi Arabia..

ACADEMIC TEACHING CONTRIBUTION

- ❖ **CHE 313** Heat Transfer Operations.
- ❖ **CHE 314** Mass Transfer Operations.

CURRENT RESEARCH INTERESTS

1. Evaluation of Chemical and Petrochemical Industries
2. Chemical Reaction Engineering and Catalysis
3. Dry reforming of methane
4. Energy (Conservation, Hydrogen)

ACADEMIC WORKS & ACTIVITIES

- ❖ Teaching and tutoring chemical engineering courses in KSU, Riyadh
- ❖ Supervisor of Sana'a, Taiz Universities, Riyadh, KSA
- ❖ Short course on nano-technology, 3 days, Riyadh.
- ❖ Session Chairman the 2011 International Conference on Chemical, Material and Metallurgical Engineering (ICCMME 2011) Beihai, China, Dec 23-25.

RESEARCH PROJECT ACCOMPLISHED

- ❖ Acetic acid Production.
- ❖ Methane Reforming.
- ❖ Two phase Bubble column flow study using ECT.
- ❖ Photo-catalytic reactions.

PATENTS

1. Karim, K., Mamedov, E., Al-Hazmi, M.H., Fakeeha, A.H., Soliman.M.A.,Al-Zeghayer,Y.S., **Al-Fatish, A.S.**, Al-Arif, A.A.,“Catalysts methods for producing acetic acid from ethane oxidation using MO , V , PD and NB based catalysts , processes of making same and methods of using same”, United states Patent 6310241 , October 30 , 2001.
2. Karim, K., Mamedov, E., Al-Hazmi, M.H., Fakeeha, A.H., Soliman.M.A.,Al-Zeghayer,Y.S., **Al-Fatish, A.S.**, Al-Arif, A.A.,“Catalysts for producing acetic acid from ethane oxidation , processes of making the same and methods of using the same”, United states Patent 6383977, May 7, 2002.
3. Karim, K., Mamedov, E., Al-Hazmi, M.H., Fakeeha, A.H., Soliman. M.A., Al-Zeghayer, Y.S., **Al-Fatish, A.S.**, Al-Arif, A.A., “Catalysts for producing acetic acid from ethane oxidation, processes of making same and method of using same” , United states Patent 6030920, February 29,2000.

Dr. Ahmed Aidid Ibrahim

Researcher

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Researcher

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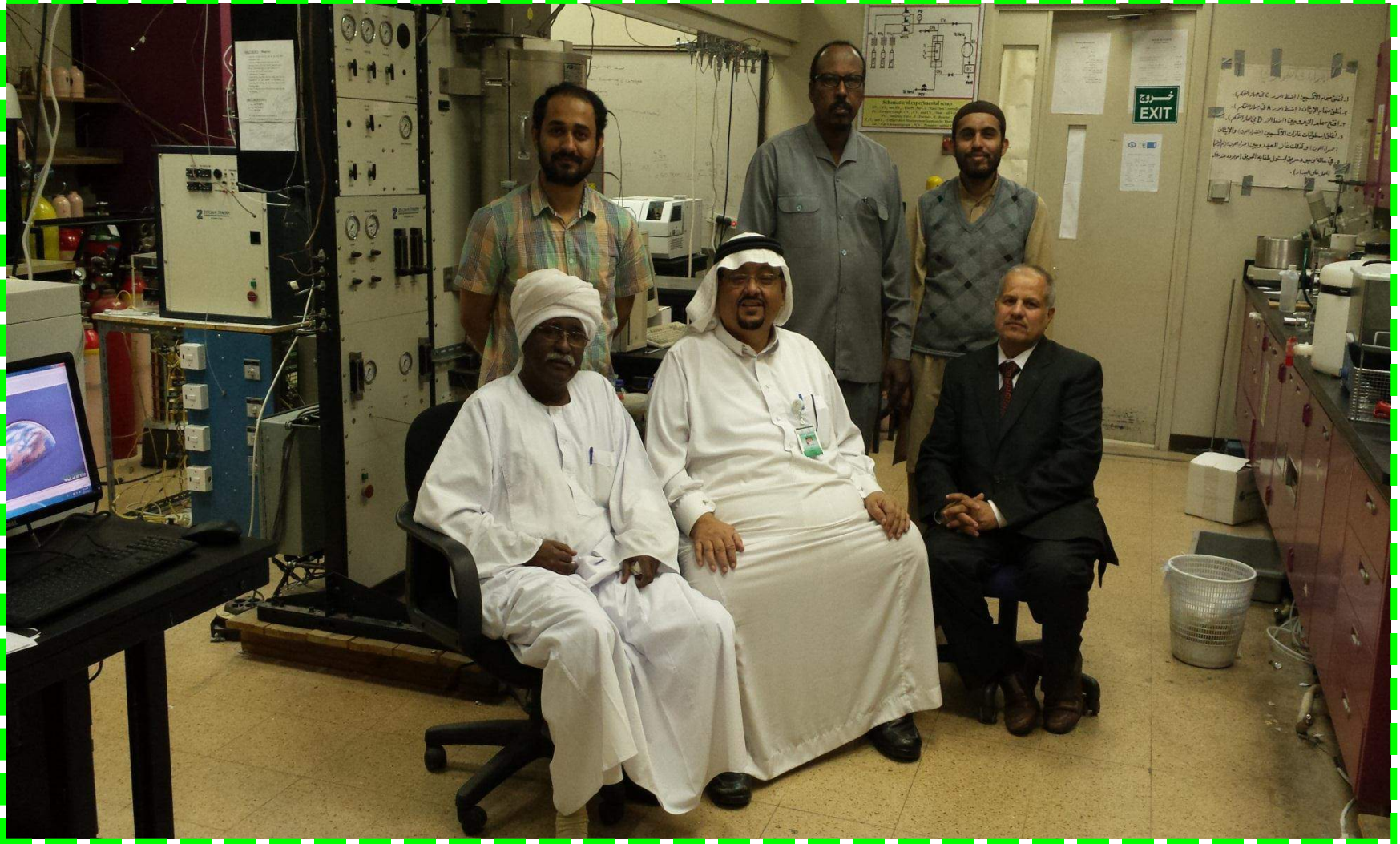
Emails: wasimkhan49@gmail.com



PICTURE GALLERY



Prof. Dr. Anis receiving “*King Abdulaziz Legion of Honor Medal (First Class Award)*” for acquiring scientific patent from “**King Abdullah Bin Abdulaziz**” in 28th Shaban 1425H (2004G).



Research Team Group Photo (17/12/2014)

Research

Overall, our research group interest lies on an interdisciplinary field including Heterogeneous Catalysis, Chemical Reaction Engineering, Nano Materials and Reduction of Green-house Gases.

Presently, the main focus of our research group is on Hydrogen and/or Syngas production, via environment friendly routes, to meet the future energy requirements.

Research on Hydrogen and/or Syngas production concentrates on:

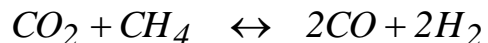
- (i) Carbon dioxide (or dry) reforming of methane.
- (ii) Oxy reforming of methane.
- (iii) Catalytic decomposition of methane.

Dry Reforming of Methane (DRM)

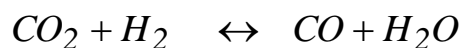
The global climatic variations and environmental protection regulations stress on the reduction of discharge of green-house gases into the atmosphere. Among the green-house gases, CO₂ and CH₄ emissions have been blamed to be the leading driving factors that cause the phenomenon of global warming. The carbon dioxide or dry reforming of methane (DRM) has gained special attention since the last decade, because this process not only consumes and/or mitigates two GHG (CO₂ and CH₄) but also produces syngas (a mixture of CO and H₂) with H₂/CO molar ratio closer to unity which is more suitable for production of valuable synthetic liquid fuels and oxygenated chemicals via oxo- and Fischer-Tropsch synthesis processes.

The network reactions in dry reforming are summarized as follows;

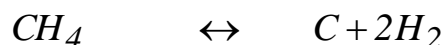
Main DRM reaction



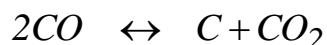
Reverse water gas shift reaction



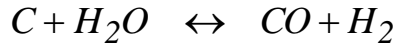
Methane cracking/decomposition reaction



Boudouard reaction



Steam coke gasification reaction



The following Fig. 1 shows the different applications of syngas and the general mechanism of DRM reaction, over metal supported catalyst.

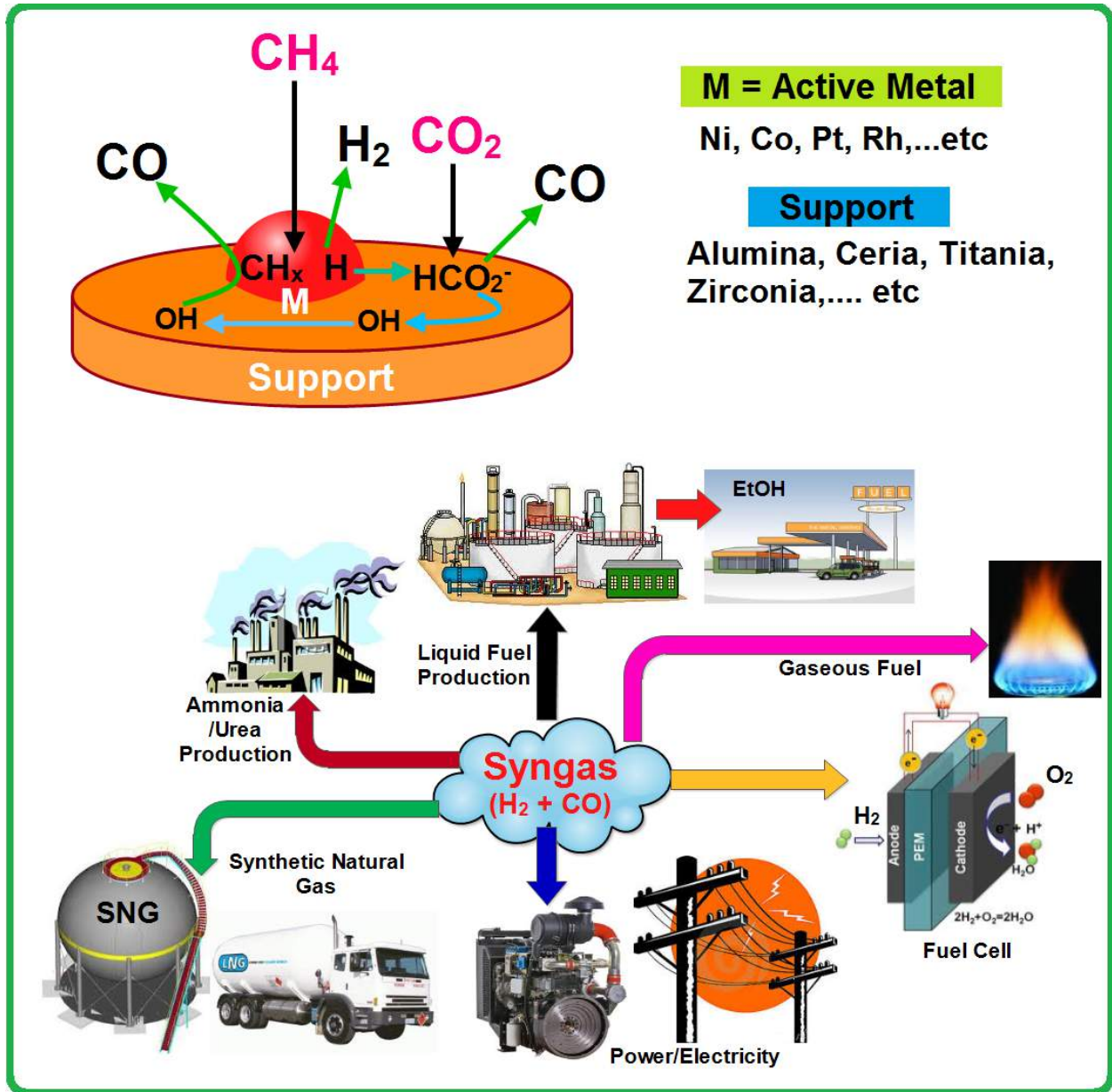


Fig. 1. General mechanism of DRM reaction and applications of syngas.

Catalytic Decomposition of Methane (CDM)

Interest on hydrogen production as a clean source of energy has been steadily increasing in recent years. Hydrogen, being the most environmentally acceptable energy source, enjoys many uses including fuel cells, a fuel for spaceships and more recently automobiles. It is also used as a reducing agent and for conversion of heavy petroleum fractions into lighter ones. Hydrogen is traditionally produced through coal gasification, steam reforming of natural gas and water electrolysis. Currently, steam reforming of methane is the main source for most of the commercial hydrogen production processes. However, the main issue associated with steam methane reforming is the production of 0.43 moles of CO_2 against each mole of hydrogen.

This environmental concern has attracted the researcher's interest to seek alternative ways for hydrogen production in recent decades. Methane decomposition over a catalytic system, also called catalytic decomposition of methane (CDM), produces CO_x -free H_2 and thus can be taken as a potential alternative for high purity H_2 production. CDM is single step reaction that involves the decomposition of the methane molecule to yield hydrogen and solid carbon.

The carbon produced in this reaction has several commercial applications, which provides positive impact on the overall economy of the process. Fig. 2 presents the

formation of carbon nano-fibers over Ni-Co bimetallic catalyst used in CDM process.

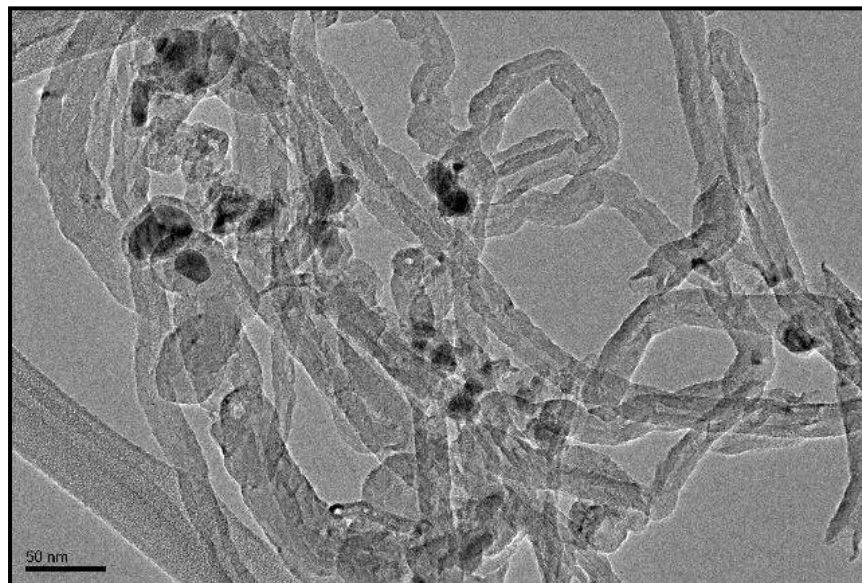


Fig. 2. SEM and TEM micrographs of carbon nano-fibers formed in CDM process.

Available Facilities in our Laboratory

PID Eng & Tech Microactivity-Reference for Evaluating Catalytic Activity and Life Time of Heterogeneous Catalysts.



Shimadzu GC-2014 AT (FID/TCD).



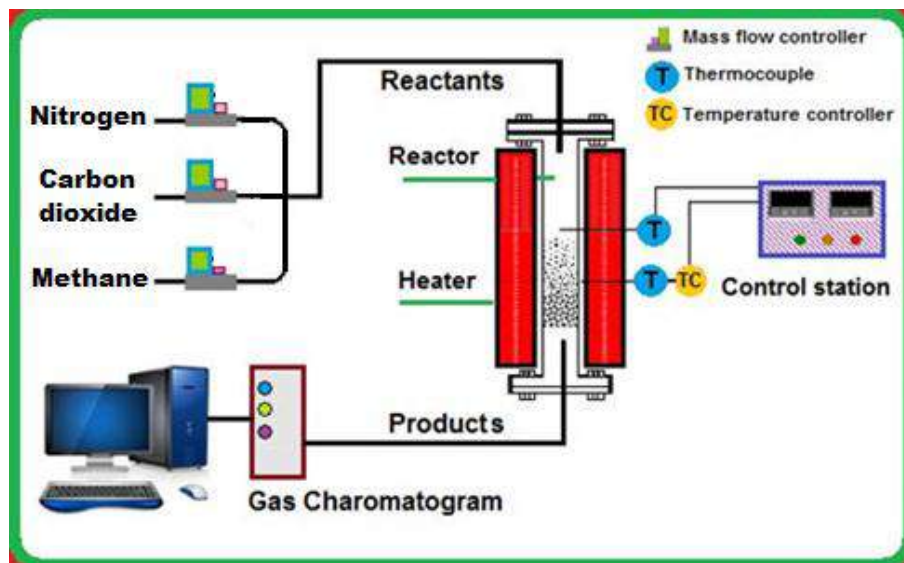
PID Effi Microactivity Reactor (Double Furnace).



Gas Chromatograph (GC) Varian Star 3400



Reaction Rig for DRM process (Thermcraft fixed bed tubular reactor)



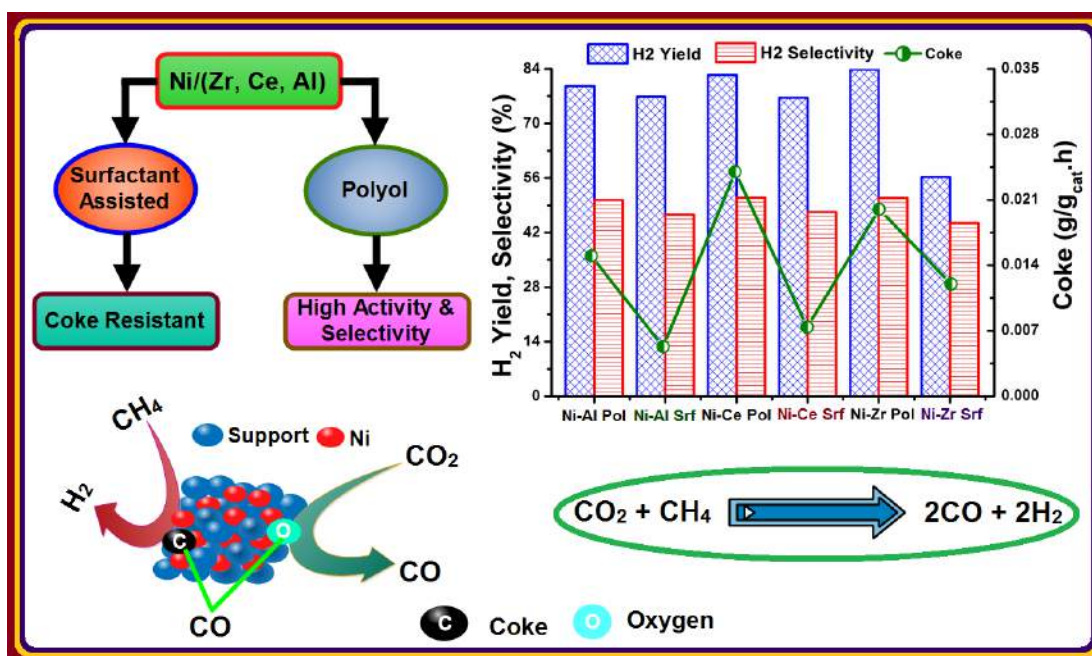
Other State of the Art, Inter and Intra Departmental, Available Facilities at King Saud University

- ❖ Micromeritics Tristar II 3020 Surface Area and Porosity Analyzer.
- ❖ Micromeritics Auto Chem II 2920 Chemisorption Analyzer.
- ❖ EXSTAR SII TG/DTA 7300 Thermo-gravimetric/Differential Analyzer (TGA/DTA).
- ❖ JEOL JEM-2100F, High Resolution Transmission Electron Microscope.
- ❖ JSM-7500F, Field Emission Scanning Electron Microscope.
- ❖ Shimadzu IR Prestige-21 FTIR Spectrophotometer.
- ❖ Nano Plus (Nano Particle Size and Zeta Potential Analyzer).

Selected Publications

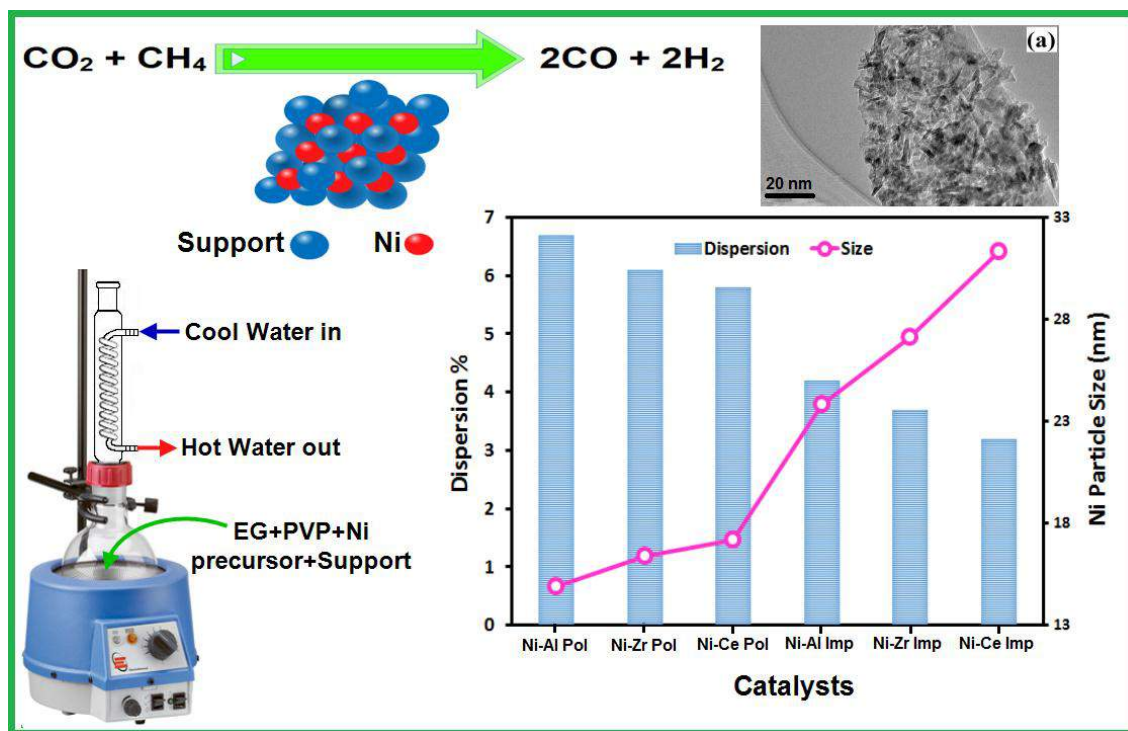
Journal publications

1. A. A. Ibrahim, A. H. Fakeeha, A. S. Al-Fatesh, A. E. Abasaheed, W. U. Khan, "Methane decomposition over iron catalyst for hydrogen production", International Journal of Hydrogen Energy. (In Press) (doi:10.1016/j.ijhydene.2014.10.058).
2. A. S. Al-Fatesh, "Suppression of carbon formation in CH₄-CO₂ reforming by addition of Sr into bimetallic Ni-Co/ γ -Al₂O₃ catalyst" Journal of King Saud University-Engineering Sciences. (In Press) (doi:10.1016/j.ijhydene.2014.10.058).
3. M. A. Naeem, A. S. Al-Fatesh, A. E. Abasaheed, A. H. Fakeeha, "Hydrogen production from methane dry reforming over nickel-based nanocatalysts using surfactant-assisted or polyol method", International Journal of Hydrogen Energy. 39 (2014) 17009-17023.

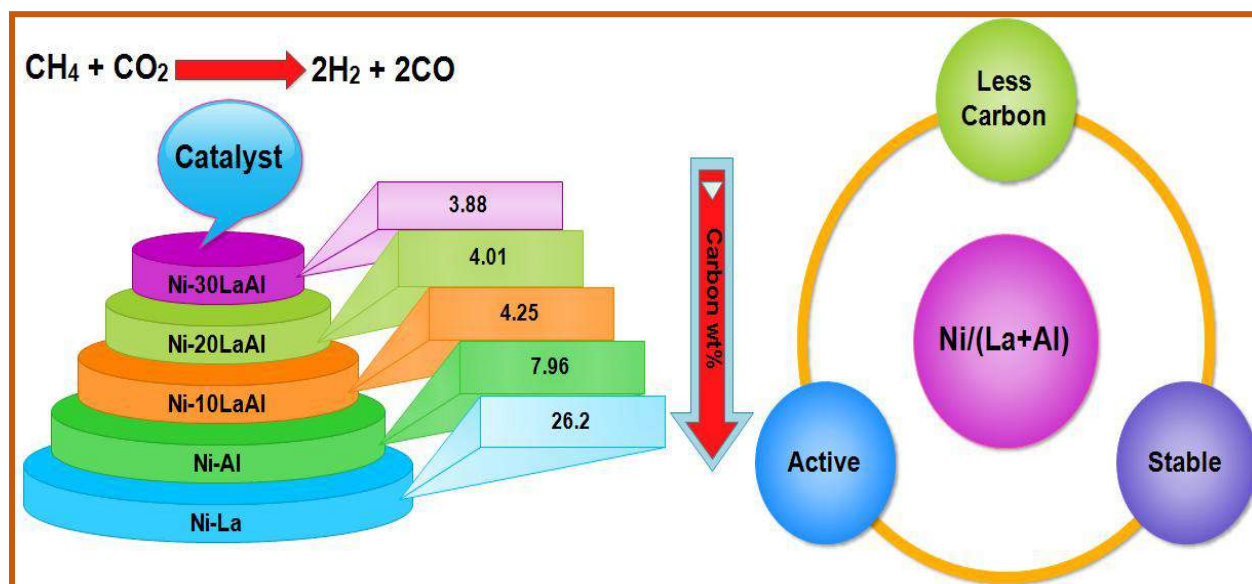


4. A. H. Fakeeha, M. A. Naeem, W. U. Khan, A. E. Abasaheed, A. S. Al-Fatesh, "Reforming of methane by CO₂ over bimetallic Ni-Mn/ γ -Al₂O₃ catalyst", Chinese Journal of Chemical Physics. 27 (2014) 214-220.
5. W. U. Khan, A. H. Fakeeha, A. S. Al-Fatish, M. A. Naeem, A. I. Aidid, A. E. Abasaheed, "Catalytic decomposition of methane over La₂O₃ supported mono- and bimetallic catalysts", Applied Mechanics and Materials. 625 (2014) 275-279.

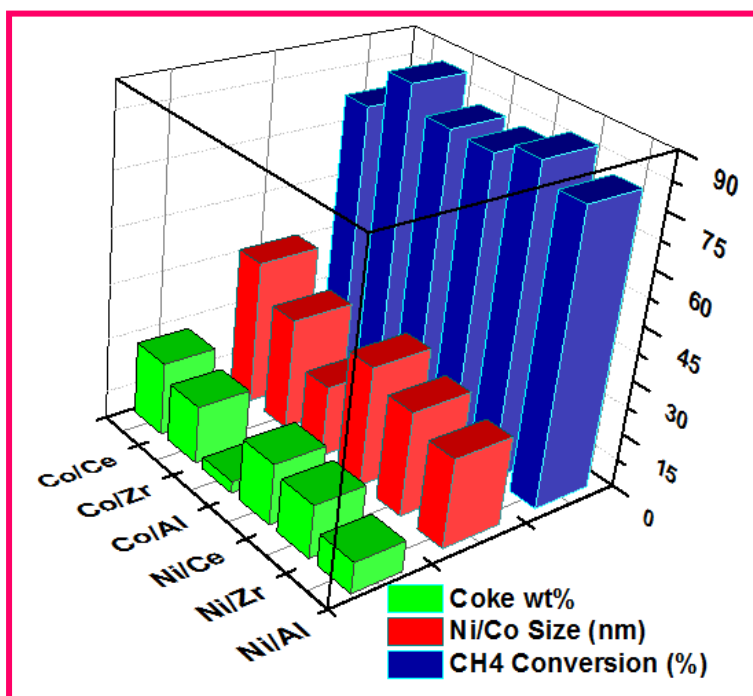
6. M. A. Naeem, A. S. Al-Fatesh, A. E. Abasaheed, A. H. Fakeeha, "Activities of Ni-based nano catalysts for CO₂-CH₄ reforming prepared by polyol process", Fuel Processing Technology. 122 (2014) 141–152.



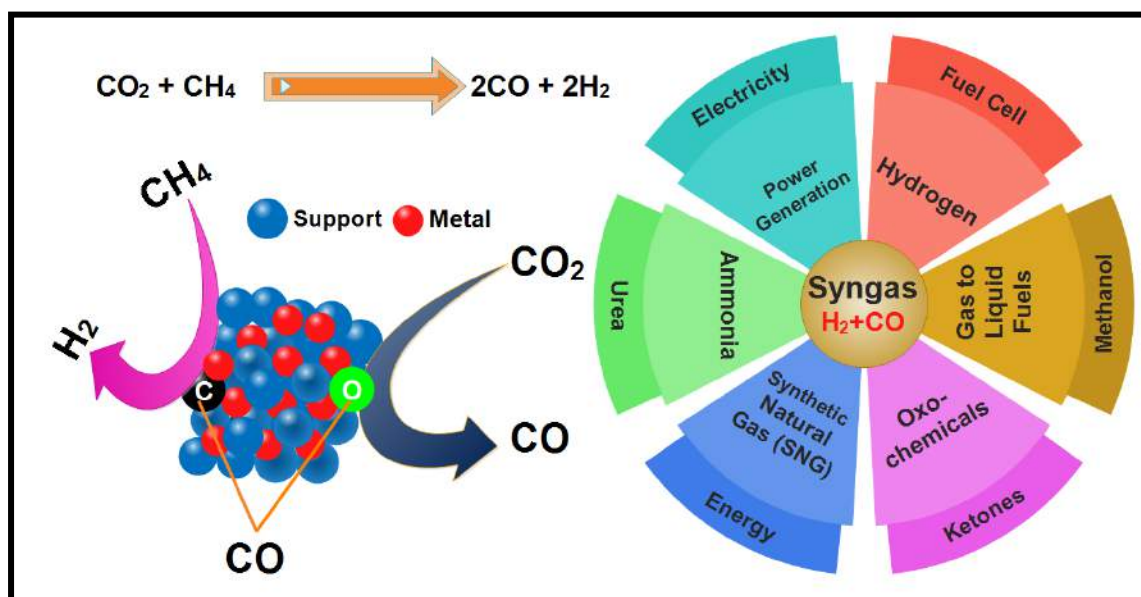
7. A. S. Al-Fatesh, M. A. Naeem, A. H. Fakeeha, A. E. Abasaheed, "Role of La₂O₃ as promoter and support in Ni/γ-Al₂O₃ catalysts for dry reforming of methane", Chinese Journal of Chemical Engineering. 22 (2014) 28–37.



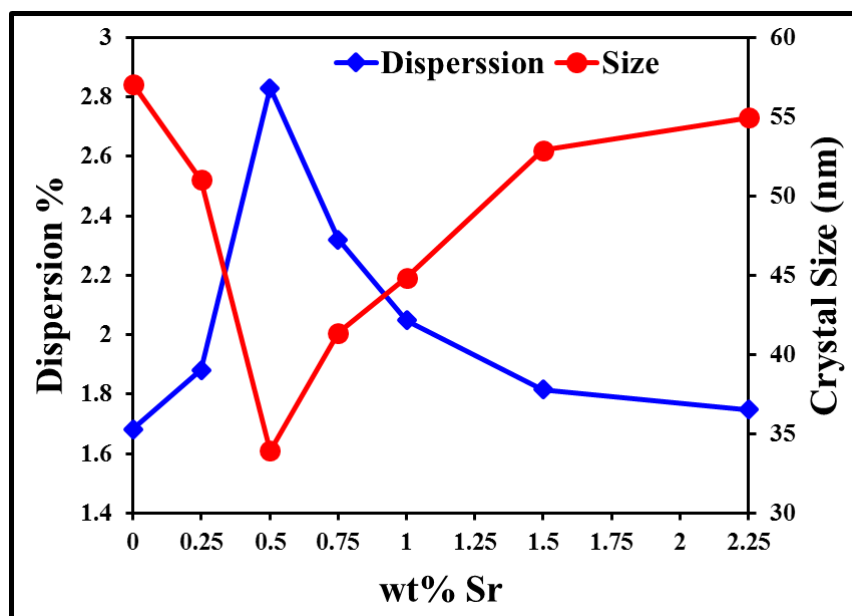
8. A. S. Al-Fatesh, M. A. Naeem, W. U. Khan, A. H. Fakeeha, "Effect of nano-support and type of active metal on reforming of CH_4 with CO_2 ", Journal of the Chinese Chemical Society. 61 (2014) 461–470.



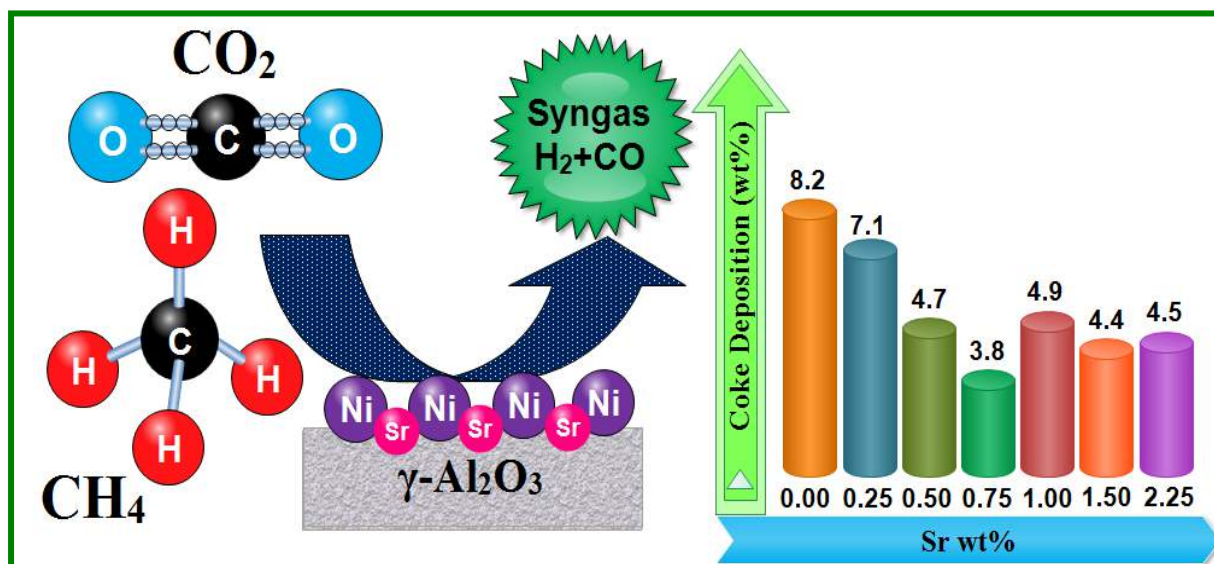
9. A. S. Al-Fatesh, A. A. Ibrahim, S. Haider, A. H. Fakeeha, "Sustainable production of synthesis gases via state of the art metal supported catalytic systems: An overview", Journal of the Chinese Chemical Society. 60 (2013) 1297–1308.



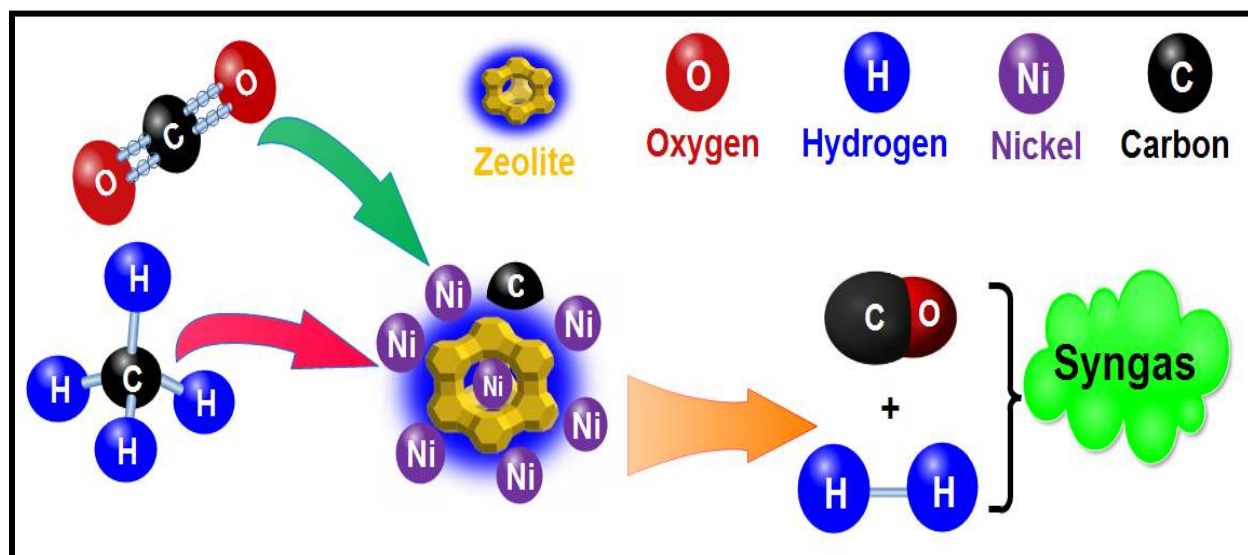
10. M. A. Naeem, A. S. Al-Fatesh, W. U. Khan, A. E. Abasaheed, A. H. Fakeeha, "Syngas production from dry reforming of methane over nano Ni polyol catalysts", *Int. J. Chem. Eng. Appl.* 4(5) (2013) 315–320.
11. A. H. Fakeeha, M. A. Naeem, W. U. Khan, A. S. Al-Fatesh, "Syngas production via CO₂ reforming of methane using Co-Sr-Al catalyst", *Journal of Industrial and Engineering Chemistry.* 20 (2014) 549–557.



12. A. S. Al-Fatesh, M. A. Naeem, A. H. Fakeeha, A. E. Abasaheed, "CO₂ reforming of methane to produce syngas over γ -Al₂O₃ supported Ni-Sr catalysts", *Bulletin of the Chemical Society of Japan.* 86 (2013) 742-746.



13. A. H. Fakeeha, Wasim U. Khan, A. S. Al-Fatesh, A. E. Abasaheed, “Stabilities of zeolite-supported Ni catalysts for dry reforming of methane”; Chinese Journal of Catalysis, 34(4), 2013, 764-768.



14. A. S. Al-Fatesh, A. H. Fakeeha, “Methane reforming using a Ni-Ag/ γ -Al₂O₃ catalyst”, Journal of chemical engineering of Japan. 46 (2013) 158-161.
15. A. S. A. Al-Fatesh, A. H. Fakeeha, “Effects of calcination and activation temperature on dry reforming catalysts”, Journal of Saudi Chemical Society. 16 (2012) 55-61.
16. A. H. Fakeeha. A. S. Al-Fatesh, A. E. Abasaheed, “Ni/Y-Zeolite catalysts for carbon dioxide reforming of methane”, Advanced Materials Research. 550-553 (2012) 325-328.
17. A. S. Al-Fatesh, A. H, Fakeeha, A. E. Abasaheed, “Effect of Pd on CH₄ reforming with CO₂ catalyzed by Ni over mixed Titian-Alumina support”, Advanced Materials Research. 476-478 (2012) 513-518.
18. A. H. Fakeeha, A. S.A. Al-Fatesh, A. E. Abasaheed, “Modification of alumina support with TiO₂-P25 in CO₂ reforming of CH₄”, Journal of Industrial and Engineering Chemistry. 18 (2012) 212–217.
19. A. S. A. Al-Fatesh, A. H. Fakeeha, A. E. Abasaheed, “Effects of Selected Promoters on Ni/ γ -Al₂O₃ catalyst performance in methane dry reforming”, Chinese Journal of Catalysis. 32 (2011) 1604–1609.
20. A. S. Al-Fatesh, A. A. Ibrahim, A. H. Fakeeha, A. E. Abasaheed, “Activity and carbon formation of a low Ni-loading alumina-supported catalyst”, Journal of Chemical Engineering of Japan. 44 (2011) 328-335.

21. A. H. Fakeeha, A. A. Ibrahim, A. S. Al-Fatesh, A. E. Abasaheed, "CO₂ reforming of CH₄ for Mitigation of green-house gases", Res. J. Chem. Environ. 15 (2011) 836-841.
22. A. S. Al-Fatesh, A. H. Fakeeha, "Investigation of suitable pretreatment for dry reforming of methane over Ni/Al₂O₃", Advanced Materials Research. 233-235 (2011) 1665-1673.
23. A. S. A. Al-Fatesh, A. H. Fakeeha, "Reduction of green-house gases by dry reforming: Effect of support", Res. J. Chem. Environ. 15 (2011) 259-268.
24. A. S. A. Al-Fatesh, A. A. Ibrahim, A. H. Fakeeha, M. R. H. Siddiqui, A.E. Abasaheed, "Oxidative CO₂ reforming of CH₄ over Ni/ α -Al₂O₃ catalyst", Journal of Industrial and Engineering Chemistry. 17 (2011) 479-483.
25. A. S. A. Al-Fatish, A. A. Ibrahim, A. H. Fakeeha, M. A. Soliman, M. R. H. Siddiqui, A. E. Abasaheed, "Coke formation during CO₂ reforming of CH₄ over alumina-supported nickel catalysts", Applied Catalysis A: General. 364 (2009) 150-155.
26. A. H. Fakeeha, M. A. Soliman, S. M. Alwahabi, Y. M. Fahmy, A. A. Ibrahim, "Influence of MO-Doping on VPO catalyst for partial oxidation of ethane", Journal of Saudi Chemical Society. 9 (2005) 287-296.
27. A. H. Fakeeha, F. A. Abdelaleem, A. A. Ibrahim, "Preparation of hydrogen evolution electrode by addition of zinc metal to nickel", Al-Azhar University Engineering Journal. 8 (2005) 229-235.

Conference proceedings

1. A. S. Al-Fatesh, M. A. Naeem, A. A. Ibrahim, A. H. Fakeeha, "Effect of Tb promoter on catalytic performance of Ni/ZrO₂ catalysts in carbon dioxide reforming of methane", 8th International Conference on Environmental Catalysis, Asheville, North Carolina, United States of America, 24-27 August 2014.
2. A. A. Ibrahim, A. H. Fakeeha, A. E. Abaseed, M. A. Naeem, A. S. Al-Fatesh, "Study of synthesis gas production via CO₂ reforming of CH₄ over supported cobalt catalysts", 8th International Conference on Environmental Catalysis, Asheville, North Carolina, United States of America, 24 - 27 August 2014.
3. A. A. Ibrahim, A. H. Fakeeha, A. S. Al-Fatesh, A. E. Abasaeed, W. U. Khan, "Methane decomposition over iron catalyst for hydrogen production", 13th International Conference on Clean Energy 2014 (ICCE-2014). Istanbul-Turkey, 8–12 June 2014.
4. A. H. Fakeeha, M. A. Naeem, A. E. Abasaeed, W. U. Khan, A. S. Al-Fatesh, "Highly coke-resistant novel Ni-Ho/ZrO₂ catalyst for dry reforming of methane", 13th International Conference on Clean Energy 2014 (ICCE-2014). Istanbul-Turkey, 8–12 June 2014.
5. A. E. Abasaeed, A. S. Al-Fatesh, M. A. Naeem, A. A. Ibrahim, A. H. Fakeeha, "Production of hydrogen via dry reforming of methane over Co-based catalysts", The 20th World Hydrogen Energy Conference. Gwangju, Korea, 15–20 June 2014.
6. A. H. Fakeeha, A. A. Ibrahim, M. A. Naeem, A. S. Al-Fatesh, "Energy source from hydrogen production via methane dry reforming", Fourth International Conference on Industrial Engineering and Operations Management, Bali, Indonesia, 7-9 January 2014.
7. A. H. Fakeeha, "Enhancing energy production in power plants by utilizing exhaust gases", Global Engineering. Science and Technology Conference, Singapore, 3–4 October 2013.
8. W. U. Khan, M. A. Naeem, A. H. Fakeeha, A. S. Al-Fatesh, A. E. Abasaeed, "Ni-Co bimetallic catalyst for catalytic decomposition of methane", Middle East Process Engineering Conference and Exhibition, Bahrain, 29 Sep –2 Oct (2013).
9. A. S. Al-Fatesh, M. A. Naeem, A. H. Fakeeha, "Effect of Sr on Ni-Co bimetallic catalyst for dry reforming", 11th International European Congress on Catalysis, EuropaCat-XI, Lyon, France, 1–6 September 2013.

10. A. A. Ibrahim, A. H. Fakeeha, M. A. Naeem, A. S. Al-Fatesh, "Hydrogen production from dry reforming of methane using γ -Al₂O₃ supported Co-Sr catalyst", 11th International European Congress on Catalysis, EuropaCat-XI, Lyon, France, 1–6 September 2013.
11. A. S. Al-Fatesh, A. H. Fakeeha, A. E. Abasaheed, "Effect of Mn promoter on Ni-based catalysts supported on γ -Al₂O₃", The Sixth Jordan International Chemical Engineering Conference (JICHEC 06), Amman-Jordan, 12-14 March 2012.
12. A. S. Al-Fatesh, A. H. Fakeeha, A. A. Ibrahim, A. E. Abasaheed, "Effect of Calcium promoter on Ni-based catalysts supported on α -Al₂O₃ and TiO₂-P25", The 2011 International Conference on Chemical, Material and Metallurgical Engineering (ICCMME 2011), Beihai, China, 23-25 December 2011.
13. A. H. Fakeeha, A. S. A. Al-Fatesh, "Effect of TiO₂-P25 addition on Ni/ α -Al₂O₃ catalytic activity in CO₂ reforming of methane", First United Arab Emirates Conference on Pure and Applied Chemistry (ECPAC11) American University of Sharjah, 1-3 March 2011.
14. A. S. A. Al-Fatesh, A. H. Fakeeha, "Effect of Pd and Ce promoters on the activity of Ni/ γ -Al₂O₃ catalysts for the dry reforming of methane", 11th International Chemistry Conference and Exhibition in Africa, Egypt, Luxor, 20-23 November 2010.
15. A. H. Fakeeha, A. S. Al-Fatish, M. A. Soliman, A. A. Ibrahim, "Utilization of carbon dioxide in dry reforming reaction to produce synthesis gas used as feed for petrochemical industries", The seventh International Conference on Chemistry In Industry, Manama, Kingdom of Bahrain, 26-28 March 2007.
16. A. H. Fakeeha, A. S. AL Fatish, M. A. Soliman, A. A. Ibrahim, "Catalyst preparation for CO₂ utilization in reforming of methane", First Afro-Asian Conference on Advanced Material Science and Technology, Cairo – Egypt, 13-16 November 2006.
17. A. H. Fakeeha, A. S. AL Fatish, M. A. Soliman, A. A. Ibrahim, "Effect of changing CH₄/CO₂ ratio on hydrogen production by dry reforming reaction", 16th World Hydrogen Energy Conference, Lyon, France, 13-16 June 2006.
18. A. H. Fakeeha, M. A. Soliman, A. S. AL Fatish, "Effect of catalyst preparation on dry reforming of methane", 3rd International Conference on Chemical & Environmental Engineering, Military Technical College, Cairo Egypt, 16-18 May 2006.

19. A. H. Fakeeha, M. A. Soliman, A. S. AL Fatish, “The effect of using different supports on the production of hydrogen by dry reforming”, Proceeding of 1st European Hydrogen Energy Conference, Grenoble, France, 2-5 September 2003.
20. A. H. Fakeeha, M. A. Soliman, A. S. AL Fatish, “Effect of Promoters on hydrogen production by dry reforming Reaction”, Proceeding of 2nd European Hydrogen Energy Conference, Zaragoza, Spain, 22-25 September 2005.