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IHTEC 2025
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9th International HYDROGEN TECHNOLOGIES Congress

25-28 May 2025
Dokuz Eylül University, İzmir, Türkiye



EDITORS
Can Özgür Çolpan
Azize Ayol
Mehmet Akif Ezan
Mustafa Umut Karaoğlan

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PROCEEDINGS

International Association for Hydrogen Energy

International Journal of Hydrogen Energy

Cooperating Institutions

TENMAK
TURKISH ENERGY, NUCLEAR AND MINERAL RESEARCH AGENCY

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International Journal of Hydrogen Energy

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FOREWORDS

MESSAGE FROM THE PRESIDENT

The Hydrogen Technologies Association has continued its mission of promoting research, development, and innovation in the field of hydrogen energy, while fostering collaboration between academia, industry, and government at both national and international levels. Over the years, the Association has organized numerous scientific and technical events, creating valuable opportunities for knowledge exchange and partnership building. These efforts have strengthened Turkey's role in the global hydrogen community and contributed to advancing sustainable energy solutions.

The 9th International Hydrogen Technologies Congress (IHTEC-2025) was successfully held in İzmir, Türkiye, from May 25 to 28, 2025, under the joint organization of Dokuz Eylül University and the Hydrogen Technologies Association. This year's congress brought together more than 500 participants from 25 countries and numerous companies with their latest products and technologies, providing a dynamic platform for presenting the latest scientific findings and technological developments in hydrogen production, storage, and utilization, and their applications in various sectors. The program featured a rich combination of thematic sessions, special sessions, panel discussions, and a dedicated workshop, contributing to productive conversations and new collaborations. The successful realization of IHTEC-2025 was made possible by the dedication and efforts of the Rector of Dokuz Eylül University and Honorary Chair, Prof. Dr. Bayram Yılmaz, and the Congress Co-Chairs, Prof. Dr. Can Özgür Çolpan and Prof. Dr. Azize Ayol. I also sincerely thank the organizing and executive committees, technical chairs, session chairs, speakers, authors, and volunteers for their valuable contributions. I would like to thank our sponsors for their generous support.

I believe that the networks established and the knowledge shared during IHTEC-2025 will continue to inspire progress towards a cleaner, more sustainable, and innovative hydrogen energy future. I look forward to welcoming our community to IHTEC-2026 in the Istinye University in Istanbul, where we will strengthen international cooperation and further contribute to the global advancement of hydrogen technologies.

Prof. Dr. İbrahim Dinçer
President, National Hydrogen Association

FOREWORDS

MESSAGE FROM THE CHAIRS

We are delighted to present the proceedings of the 9th International Hydrogen Technologies Congress (IHTEC-2025), held in İzmir, Türkiye, from May 25 to 28, 2025, under the joint organization of Dokuz Eylül University and the Hydrogen Technologies Association.

IHTEC-2025 brought together over 400 participants from 25 countries, creating a dynamic international platform for the exchange of scientific and technological knowledge in hydrogen energy. The scientific program featured 269 oral and 73 poster presentations across 36 thematic sessions, along with 2 special sessions, 2 panel discussions, and 1 dedicated workshop, covering key topics ranging from hydrogen production and storage to its applications in industry and defense.

The congress officially opened with addresses by Prof. Dr. Can Özgür Çolpan and Prof. Dr. Azize Ayol (Congress Co-Chairs), Prof. Dr. Bayram Yılmaz (Rector of Dokuz Eylül University and Honorary Chair), and Dr. Süleyman Elban (Governor of İzmir), whose participation and support we gratefully acknowledge. The plenary session continued with an insightful overview by Prof. Dr. İbrahim Dinçer (President of the Hydrogen Technologies Association), followed by a special talk by Dr. Abdullah Buğrahan Karaveli (President of TENMAK), both of whom provided valuable perspectives on hydrogen's strategic importance.

We were honored by the contributions of distinguished keynote and invited speakers, including Prof. Luigi Crema (President of Hydrogen Europe Research / Fondazione Bruno Kessler, Italy), Prof. Adélio Mendes (University of Porto, Portugal), Prof. John Irvine (University of St Andrews, UK), Prof. Eileen Yu (University of Southampton, UK), Prof. Feridun Hamdullahpur (University of Waterloo, Canada), Prof. Saim Özkar (Middle East Technical University, Türkiye), and Dr. Tareq Al-Ansari (Qatar Environment and Energy Research Institute, Qatar), who greatly enriched the scientific program.

Two high-level panel sessions enriched the IHTEC-2025 program. The pre-congress panel, titled "Innovative Hydrogen Policies in Combating Climate Change," was moderated by Prof. Dr. Adnan Midilli (ITU Energy Institute), featuring Prof. Dr. Arif Hepbaşlı (Yaşar University), Osman Arda Göçmen (Ford Otosan), Elis Şaşmaz (Topkapı Industry), and Yusuf Can Uz (Filament Technology). The second panel, "Hydrogen Technologies in the Defense Industry," was coordinated by Prof. Dr. Can Özgür Çolpan and Prof. Dr. Hüseyin Turan Arat (Sinop University) and moderated by Prof. Dr. Selmiye Alkan Gürsel (Sabancı University). This panel included key experts from the national defense sector: Deniz Demirci (Presidency of Defense Industries - SSB), Hüseyin Devrim (TEKSİS), Uğur Kayasal (Roketsan Missiles Inc.), Devrim Köseoğlu (TUSAŞ), and İbrahim Pamuk (LENTATEK). We sincerely thank all moderators and panelists for their valuable insights into the policy and strategic dimensions of hydrogen technologies.

A dedicated workshop on "Innovations on Hydrogen-based Processes & Technologies" was organized by Dr. Adolfo Iulianelli (CNR-ITM, Italy) and Dr. Canan Acar (University of Twente, Netherlands). The workshop provided a focused environment for discussions on membrane processes, hydrogen production systems, and fuel cell innovations. In addition, a special session on "Membrane Technologies in Hydrogen Production, Separation and Utilization" was coordinated by Prof. Dr. Can Özgür Çolpan and Dr. Adolfo Iulianelli. The session covered a broad range of timely topics including membrane engineering in the hydrogen economy, renewable sources and catalytic systems for hydrogen generation, hydrogen separation/purification and utilization by membrane technologies, hybrid industrial plant solutions for decarbonized hydrogen generation, and hydrogen and fuel cells. We extend our sincere thanks to all speakers who contributed their expertise and insights to this special session.

The successful realization of IHTEC-2025 was made possible through the commitment and collaboration of many individuals and institutions. We extend our sincere gratitude to Prof. Dr. Bayram Yılmaz, Rector of Dokuz Eylül University, for his unwavering support, and to Prof. Dr. İbrahim Dinçer, President of the Hydrogen Technologies Association and General Chair of the congress, for his visionary leadership. We would also like to thank Prof. Dr. Mehmet Akif Ezan and Assoc. Prof. Dr. Mustafa Umut Karaoğlan, the Technical Co-Chairs, for their outstanding efforts in shaping the scientific program, as well as the organizing and executive committees, the international scientific board, the reviewers, and the volunteers.

We are deeply grateful to our sponsors, whose generous support ensured the successful execution of the event. These include TENMAK, ARMELSAN Enerji, HABAŞ, Anton Paar, Hydrogenix, International Association for Hydrogen Energy (IAHE), BPlas, Doğu İklimlendirme, Koç University Hydrogen Technologies Center, TÜBİTAK, Consapp Engineering, Truva Bakır, Kurukahveci Mehmet Efendi, BREW MOOD COFFEE TEA, KFC Gıda, Dimes A.Ş., and Eker.

We believe that the knowledge shared and the collaborations formed during IHTEC-2025 will contribute meaningfully to the advancement of hydrogen-based solutions for a more sustainable future. Serving as Co-Chairs of this international event has been a great honor and a reflection of our shared commitment to progress in hydrogen technologies.

We thank all participants for their valuable contributions and hope to see continued collaboration and innovation in future editions of IHTEC.

Kind regards,

Prof. Dr. Can Özgür Çolpan & Prof. Dr. Azize Ayol
Congress Co-Chairs, IHTEC-2025

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SCIENTIFIC PROGRAM

SCIENTIFIC PROGRAM

Sunday – May 25, 2025

12:00 18:00	**CONFERENCE REGISTRATION**
16:30 18:00	**Pre-Congress Panel (Online / Onsite in Turkish) (HALL B)** **Innovative Hydrogen Policies in Combating Climate Change** **Moderator** **Adnan Midilli**, *ITU Energy Institute, Türkiye* **Panelists** **Arif Hepbaşlı**, *Yaşar University, Türkiye* **Hatice Eser Okten**, *IZTECH, Türkiye* **Osman Arda Göçmen**, *Ford Otosan, Türkiye* **Elis Şaşmaz**, *Topkapı Industry, Türkiye* **Yusuf Can Uz**, *Filament Technology, Türkiye*

Monday – May 26, 2025

07:30 09:00	**CONFERENCE REGISTRATION**	
09:00 09:30	**OPENING CEREMONY (HALL A)** **Can Ozgur Colpan**, *Congress Co-Chair* **Azize Ayol**, *Congress Co-Chair & Dean of Faculty of Engineering, Dokuz Eylul University* **Bayram Yılmaz**, *Honorary Chair & Rector of Dokuz Eylul University* **Süleyman Elban,** *Governor of Izmir*	
09:30 09.50	**OVERVIEW TALK (HALL A)** **Ibrahim Dincer**, *National Hydrogen Association President* **National Hydrogen Association and Critical Advantages of Hydrogen**	
09.50 10:20	**SPECIAL TALK (HALL A)** **Abdullah Bugrahan Karaveli**, *TENMAK President* **Türkiye's Long-Term Energy Strategy and the Role of Hydrogen**	
10:20 10:30	**Sponsor Recognition Ceremony (HALL A)**	
10:30 10:50	**Coffee Break**	
KEYNOTE SESSION 1 (HALL A) **Session Chair: Adolfo Iulianelli**		**EXHIBITION**
10:50 11:30	**Luigi Crema**, *President, Hydrogen Europe Research / Fondazione Bruno Kessler* **Overview on the European Research and Innovation in the Hydrogen Sector: Best Practices and Priorities**	
11:30 12:10	**Adélio Mendes**, *University of Porto, Faculty of Engineering* **Given a North to the Energy Decarbonization**	
12:10 12:20	**Family Photo (In front of Rectorate Building)**	
12:20 14:00	**LUNCH (Lokal Çatı Restaurant, Dokuz Eylul University Rectorate)**	

SCIENTIFIC PROGRAM

Monday – May 26, 2025

PARALLEL SESSIONS – 1

	HALL A	HALL B
14:00 16:00	**Session 1. Strategic Stakeholder Presentations** **Session Chairs: Adnan Midilli & Arif Hepbaşlı**	**Session 2. Fuel Cells and Applications – I** **Session Chair: Bora Timurkutluk**
	Emre Yıldırım *TENMAK, Türkiye* Strategic R&D Initiatives in Hydrogen Technologies at TENMAK	**#146** "Development of Hydrogen Powered Ejection System for Air Platforms" *T. Kalay, H. Özcan, S. Çelik* **#262** "Parametric Estimation and Performance Analysis of Direct Ethanol Fuel Cells and Lithium Batteries for Hybrid Energy Systems" *M. Yavuz Çelikdemir* **#263** "An Innovative Approach to Determine Effective Variables on Fault Detection of PEMFCs" *M. Yavuz Çelikdemir, S. Çelikdemir* **#282** "Synergistic Effects of Temperature, Gas Flow, and Clamping Force on Fuel Cell Performance" *B. Yılgın, F. G. B. San, C. Celik* **#110** "Experimental Study on Regenerative Fuel Cell Performance: Electrolyzer and Fuel Cell Mode Analysis" *M.A. Kesercioğlu, F.G. Boyacı San, N. Sözbir, Y. Çay* **#111** "Performance Optimization and Design Advancements of Proton Exchange Membrane Fuel Cells for Portable Energy Applications" *A. Algherbawi, S. Ekici*
	Hilal Gümüşlü *TENMAK, Türkiye* Policy Framework on Hydrogen Technology and Calls	
	Ali Rıza Arslan *Hydrogenix* Evaluations about Hydrogen and BESS Vehicles	
	Ornov Maulik *Anton Paar* Characterizing Metal Hydrides and their Hydrogen Storage Capacity	
	Nurettin Tekin *Kawasaki* Hydrogen Road of Kawasaki Heavy Industries	
	#238 "Innovative Blue Hydrogen Production from Gas Hydrate – Methane" *S. S. Çelebi, G. Çifçi, S. Obut, E Ercek* **#309** "Studies Conducted on On-Board/On-Site Catalytic Hydrogen Production and Carbon Capture and Utilization (CCU) in the SNG & Hyd Tec Lab at Boğaziçi University" *A. E. Aksoylu, B. S. Çağlayan*	
16:00 16:30	**Coffee Break (with Poster Session-1)**	

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PARALLEL SESSIONS – 1

HALL C

Session 3. Sustainable Hydrogen Technologies – I

Session Chair: Hüseyin Turan Arat

#224 "Enhancement of Ionic Conductivity in Anion Exchange Membranes: Effect of Modified MOF Structures in PBI Membranes" *H. Altınışık, Y. Devrim*

#287 "Applications of MWCNTs in HHO Dry Cell Technology" *M. K. Baltacıoğlu, O. Bulut, Ç. Conker*

#288 "Enhancing HHO Dry Cell Efficiency with Graphene-Supported Electrolytes" *M. K. Baltacıoğlu, O. Bulut*

#289 "Metaheuristic Optimization of PID Controllers for Temperature Regulation in HHO Dry Cells" *C. Conker, M. K. Baltacıoğlu*

#290 "Development of Dopamine Modified Graphene Oxide Doped Composite Anion Exchange Membranes" *N. G. Önel, Y. Devrim*

#275 "Preparation of Pyridine Polybenzimidazole / Amine Functionalized Boron Nitride Composite Membrane" *R. Akay, A. H. Ali, H. N. Arkalı, G. Aktaş, Z. Pekdemir, E. Erünal*

#268 "Theoretical Insights into ZIF-71: Adsorption Potential for H_2 and H_2S as well as Its Response to External Electric Field" *O. S. Sarisoy, Y. Gürdal*

#272 "H_2 Sorption Potential of ZIFs Revealed Through Grand Canonical Monte Carlo Simulations" *G. Tunç, Y. Gürdal*

HALL D

Session 4. Hydrogen Carriers – I

Session Chair: Pedro J. Megía

#134 "NH_3 Synthesis with Ca_2NH Supported Ru Catalyst Under Mild Conditions" *T. A. Boynueğri, J.T.S. Irvine, G. Irvine, S. Jowitt, O. Magdysyuk, H. Ünsal, A. Long*

#165 "A Study on Fe-Zr/Al_2O_3 Catalyst for Hydrogen Production via Sodium Borohydride Methanolysis" *E. Ertun, Ö. Şahin*

#196 "Various Metal Oxide Catalysts Supported on Al_2O_3 for Hydrogen Generation from Alkaline $NaBH_4$ Solution" *S. Salt, H. Erdoğan, H. E. Figen, M. K. Elibol*

#216 "Investigation of the Activity of Composite Nanofiber Catalysts Synthesized by Electrospinning Technique for Hydrogen Production from Boron Fuels" *B. E. Ülgen, B. C. Filiz, A. K. Figen*

#223 "Borohydrides for Highly Selective Catalytic Methanol Production: Inside into Perovskite-Type Catalyst" *G. Özdemir, B. C. Filiz, F. N. Tekeli, A. K. Figen*

#329 "Modification of MOF-235 with Graphene Oxide for Enhanced Hydrogen Production from Sodium Borohydride Hydrolysis" *R. Ozdemir, D. Unlu*

#247 "Hydrogen Production via Methanolysis of Sodium Borohydride Using La_2O_3 and $La_2O_2CO_3$ Nanowire Catalysts" *E. Engintepe, S. Duman, A. N. Akın*

#252 "Synthesis and Characterization of Nanostructured La_2O_3-Based Catalysts for Hydrogen Production via $NaBH_4$ Methanolysis" *E. Engintepe, S. Duman, A. N. Akın*

HALL E

Session 5. Modeling, Simulation, and Optimization – I

Session Chair: Thomas Fend

#241 "Machine Learning-Based Modeling and Performance Analysis of Solid Oxide Electrolysis Cells (SOECs)" *M. T. Durmaz, M. S. Akkuş*

#267 "Design and Performance Analysis of Hybrid Renewable Energy System with Hydrogen Storage: A Case Study In İzmir" *Y. A. Yıldız, Ş. E. Hayber*

#270 "Fuzzy Logic-Controlled Load Management in a Hybrid Microgrid with Fuel Cell, Wave, Solar, and Wind Power Integration" *Ş. Ataç, M. Güçyetmez*

#278 "Feature and LSTM-Based Capacity Prediction for Lithium-Ion Batteries: Application of Linear Regression and LSTM Models, with Future Expansion to Fuel Cell Datasets and Optimization" *S. Akkaya, M. Uyar*

#284 "A Data-Driven DA-LSTM Approach for Predicting PEMFC Degradation Trends in Dynamic Load Conditions" *N. K. Ekmekçi, M. Uyar*

#184 "Simulation and Analysis of Methane Thermal Decomposition in an Aerosol Flow Reactor" *İ. Ekmekci, İ. Karabay*

#218 "Development and Assessment of a Solar Energy-Based Multigeneration Plant Integrated with a Hydrogen Generation Unit for Clean Products" *F. Yılmaz, Y. E. Yuksel, M. Ozturk*

#217 "Design and Analysis of a Biomass-Based Integrated Plant for Green Hydrogen Generation and Beneficial Commodities" *F. Yılmaz, M. Ozturk, R. Selbas*

EXHIBITION

Coffee Break (with Poster Session-1)

SCIENTIFIC PROGRAM

Monday – May 26, 2025

PARALLEL SESSIONS – 2

	HALL A	HALL B
	Session 6. Catalysts for Hydrogen Applications – I **Session Chair: Ramazan Solmaz**	**Session 7. Hydrogen Vehicles and Mobility – I (Sponsored by HABAŞ)** **Session Chair: Canan Acar**
16:30 18:45	**Invited Speaker** **Saim Özkar** *Middle East Technical University, Türkiye* **Recent Advances in Catalyzing the Hydrolytic Dehydrogenation of Ammonia Borane** **#190** "The Synthesis of Ni-Co-B Catalyst for Ammonia Borane Dehydrogenation" *I. Nas, R. Kiziltas, A. Koç, E. Yildirim* **#191** "Development of Rhodium-Based Catalyst for Ammonia Borane Dehydrogenation" *A. Koç, R. Kiziltas, I. Nas, E. Yildirim* **#81** "The Effect of Different Types of Metal Phthalocyanine on the Electrodecomposition of H_2S to H_2 and Polysulfides" *F. Nazari, A. Sarioglan, M.S. Yazici* **#84** "Nickel-Lanthanum Catalysts Supported on Silicon Carbide to Produce CO_x-free Hydrogen and Valuable Carbons Under Microwave Energy" *H.P. Köse, D. Varışlı* **#85** "Development of Silicon Carbide Supported Nickel-iron Bimetallic Catalysts for Microwave-assisted Catalytic Methane Decomposition" *C. Acar, D. Varışlı* **#86** "Cu-BTC Synthesis via Solvothermal andMicrowave-assisted Methods: Characterization and Adsorbent Applications" *D. Dumlu, N. Ayas* **#124** "Enhanced Alcohol Oxidation in Acidic and Alkaline MEADIA Using Pt-Modified Nickel Layered Double Hydroxide Supported on Multiwall Carbon Nanotubes and Carbon Black Surfaces" *S. Saipanya, J. Jakmunee, L. Fang*	**#10** "Assessment of Metaheuristic Algorithms of Fuel Cell Vehicles: A Short Review" *O. Yasar, M.U. Karaoglan, C.O. Colpan* **#34** "Environmental Assessment of a Hybrid Ship Electrification System Integrating Molten Carbonate Fuel Cells, Battery, and Waste Heat Recovery" *O. Yuksel, E.Blanco-Davis, V. Shagar, A. Spiteri, D.Hitchmough, M.C. Di Piazza, M. Pucci, N.Tsoulakos, J. Wang* **#68** "Simulation of Wheeled and Tracked Fuel Cell Vehicles: A Comparative Study Using Proposed a New Tool Called PADSIP" *B. Açık, M.U. Karaoğlan, Z.S.* İşleyen **#72** "A Dual-Layered Control Strategy for Ultracapacitor/ PEMFC Hybrid Systems in Micro-FCEVs" *A. Yılmaz, N. Aksoy, G. Bayrak* **#315** "Assessment of Hydrogen and Methanol as Alternative Fuels in the Shipping Industry" *S. A. Korkmaz, E. T. Livanos, S. Afshan* **#260** "Determining the Hydrogen Pipeline Route in Türkiye for Sustainable Energy Transition Between Asia and Europe Using Hybrid Optimization" *M. T. Özdemir, S. Çelikdemir* **#36** "Effect of Hydrogen Addition on the Energy and Environmental Performance of a Compression Ignition Dual Biofuel Engine" *A. Rimkus* **#105** "An Optimization Model for Heavy-Duty Fleet Transition using Hydrogen Fuel-cell Vehicles" *F. Eser, Ş.I. Satoğlu*
19:00 20:30	**Welcoming Reception** *(Foyer)*	

SCIENTIFIC PROGRAM

Monday – May 26, 2025

PARALLEL SESSIONS – 2

HALL C

Session 8. Combustion of Hydrogen and Fuel Mixtures – I

Session Chair: Alberto Figoli

#113 "Numerical Simulations of Reacting Flows in Hydrogen Enriched Methane Blends and Pure Hydrogen Combustion" *H. Monteiro, L. Marcon, F. Oliveira, L. Vaz*

#136 "Effects of Hydrogen Enrichment and Gravity on Soot Formation in n-dodecane Laminar Diffusion Flames: A CFD Study" *A. Korucu*

#176 "Non-Premixed Hydrogen Combustion for an Industrial Ceramic Furnace: A Numerical Analysis" *S. Yılmaz, T. Bayramoğlu, K. Bayramoğlu, A. Özarslan, B. Kılıç, A. Akbay*

#319 "Predictive Modelling for Enhanced Petrol Engine Reliability with Petroleum and Hydrogen Fuels Mixture" *J. Matijošius, T. Žvirblis, A. Rimkus, U. Kale, A. Kilikevičius*

#344 "Bayesian Optimization Framework for Hosting Capacity Evaluation in Hydrogen-Electricity Integrated Networks" *S. Shahzad, H. Kilic*

#59 "Numerical Investigation of Exhaust Emissions of Hydrogen-Diesel Dual Fueled Medium-Speed Marine Diesel Engine under Different Fumigated Hydrogen Mass Fractions" *E.F. Pehlivan*

#31 "The Synergistic Effect of HHO Gas and Gasoline-Bioethanol Blends on Spark Ignition Engine Efficiency and Emissions" *A. Rimkus, E. Kozłowski, J. Matijošius, M. Zimakowska-Laskowska*

#54 "Effects of Hydrogen Addition on Methane Fuel Reactivity in High-temperature $CO_2/O_2/N_2$ Coflow in a Non-premixed Lab-scale Tube Burner" *M.K. Büyükakın*

HALL D

Session 9. Photocatalysis and Water Splitting

Session Chair: Giuseppe Barbieri

#17 "Solid Solution Oxide Catalysts for Enhanced Visible-light-driven Hydrogen Evolution by Water Splitting" *T.P. Perng*

#205 "$LaNiO_3$-Perovskite Type Photoelectrode Synthesis and Photoelectrochemical (PEC) Performance for Hydrogen Production" *B. Yıldırım, M. İ. Aydın, A. K. Figen*

#209 "Ga-Doped ZnO Coated Stainless Steel Electrodes for Photoelectrochemical Hydrogen Production" *S. Ayca, I. Dincer*

#303 "Design of a New Photonically Enhanced Electrolyser with ZnS Photocatalyst" *M. Gursoy, I. Dincer*

#350 "Development of Stability and Efficiency of $CsPbBr_3$ Perovskite Solar Cells" *Ş. Tüzüner, O. Mahmood, Ş. Ela, A. Vomiero*

#39 "Machine Learning Analysis of Photocatalytic Hydrogen Production over Halide Perovskites" *B. Yılmaz, R. Yıldırım*

#276 "Understanding the Kinetic Mechanism of WO_3 Photoanodes for PEC Applications" *E. I. Haznedar, F. Uçar, E. Ardalı, E. Altuntaş, S. Kaya*

#193 "Performance Assessment of Low-Cost Transition Metal-Based Electrode and Catalyst for Photoelectrochemical and Photocatalytic Hydrogen Generation" *M. Ayoub, I. Dincer*

#75 "Comparison of Performances of Imidazole-based Polymeric Catalysts for Hydrogen Production" *M. Zurnacı, K. Gökkuş, M. Gür*

HALL E

Session 10. Green Hydrogen Technologies

Session Chair: Bilge Coşkuner Filiz

#67 "Sustainable Energy Solutions: 3D Printed PLA-NiMo@Ag for Green Hydrogen Production" *B. Doğru Mert, H. Nazlıgül, G. Aksaray, M.E. Mert, M. Seyedzavvar, G. Kardaş*

#70 "Application of Response Surface Methodology in Hybrid Green Hydrogen System Design and Optimization" *M. Gül, E. Akyüz*

#71 "Spatial Multicriteria Decision-making for Green Hydrogen Production: A Case Study of Southern Marmara, Türkiye" *M. Gül, E. Akyüz*

#145 "Determination of Green Hydrogen Production Capacity by Wave Energy Prediction: Model Development with an Adaptive Hybrid Method" *M. Tan*

#149 "Solar Driven Green Hydrogen Production: TiO_2@ MOS_2 Nanocomposite Synthesis and Performance" *M. Yurdakul, B. Yıldırım, A.K. Figen*

#266 "MLP Hyperparameter Optimization and Price Prediction Models on Fuel-cell Stock Data: Stability and Performance Analysis" *S. Akkaya, Ş. E. Hayber*

#273 "Evaluation of Green Hydrogen Production Using Weibull and Gamma Distributions: Technical, Economic, and Environmental Perspectives" *Y. A. Yıldız, M. Güçyetmez*

#340 "Boosting the Performance of Layered Titanate in Photocatalytic Water Splitting" *E. Doustkhah*

#135 "Green Hydrogen Production in Energy Islands" *N. Yabar, C. Haydaroğlu, A.N. Akpolat, H. Kılıç*

EXHIBITION

SCIENTIFIC PROGRAM

Tuesday – May 27, 2025

PARALLEL SESSIONS – 3

	HALL A	HALL B
08:30 09:00	**Conference Registration**	
09:00 10:30	**SPECIAL SESSION** **Membrane Technologies in H_2 Production, Separation, and Utilization - I** **Session Chairs: A. Iulianelli & C.O. Colpan**	**Session 11. Catalysts for Hydrogen Applications – II** **Session Chair: Alessandra Beretta**
	Adele Brunetti *National Research Council – Institute on Membrane Technology, Italy* **Lecture 1: Sustainable E-fuel Production: Catalytic and Photocatalytic Membrane Innovations**	**#231** "Electrodeposition of Highly-Efficient Iron-Ruthenium Alloy Cathodes for Hydrogen Evolution Reaction in Alkaline Solutions" *D. Kutyła* **#237** "Electrodeposition of Nanocone-Shaped Ni–Pt Alloys for Enhanced Electrocatalytic Activity in Alkaline Solutions" *D. Kutyła* **#244** "Cobalt Doped Platinum-Cellulose-Carbon Aerogel Prepared by Supercritical Deposition as Electrocatalyst for Hydrogen Evolution Reaction" *A. Alsuhile, P. S. Pein, B. Schroeter, I. Smirnova, C. Erkey* **#254** "Investigation of the Effect of Tween Surfactant on Catalytic Performance and Structural Properties in the Electrochemical Deposition of Platinum" *J. H. Özdemir, A. K. Figen, O. K. Özdemir* **#277** "H_2 Evolution Reaction Pathways of Cobalt Based Molecular Catalysts Investigated by AB-initio Simulations" *Y. Gurdal* **#98** "Next-Gen Energy Catalysis: MXENE-Based Composites for High-Impact Hydrogen Evolution Reaction" *D. Onaylı, D.Ö. Özgür*
	Ivana Perović *Vinca Institute of Nuclear Sciences, Serbian National Institute, Serbia* **Lecture 2: Advances in Electrochemical Catalysts for Enhanced Hydrogen Production in Membrane Reactors**	
	Antonio Vita *National Research Council – Institute of Advanced Technologies for Energy, Italy* **Lecture 3: 3D-printed Ni-alloy based Structured Catalysts with Locally Tuned Porosity and Shape for Process Intensification of Ammonia Synthesis and Decomposition**	
	David Alique *Rey Juan Carlos University of Madrid, Spain* **Lecture 4: Towards the Industrialization of Pd-based Membranes Synthesis for Hydrogen Applications: Continuous Flowing Electroless Pore-Plating**	
10:30 10:50	**Coffee Break (with Poster Session-2)**	

KEYNOTE SESSION 2 (HALL A)

Session Chair: Azzam Abu Rayash

10:50 11:30	**John T. S. Irvine**, *University of St. Andrews* **Interfacial Engineering in Solid Oxide Cells**
11:30 12:10	**Eileen Yu**, *University of Southampton* **An Electrolysis and Microbial Electrochemical Hybrid System for Hydrogen Production and Wastewater Treatment**
12:10 14:00	**LUNCH** *(Lokal Çatı Restaurant, Dokuz Eylul University Rectorate)*

SCIENTIFIC PROGRAM

Tuesday – May 27, 2025

PARALLEL SESSIONS – 3

Conference Registration

HALL C	HALL D	HALL E
Session 12. Combustion of Hydrogen and Fuel Mixtures – I **Session Chair: Selda Ozkan**	**Session 13. Hydrogen in Smart Grids and Microgrids** **Session Chair: Damla Eroğlu Pala**	**Session 14. Hydrogen Safety** **Session Chair: Nader Javani**
#177 "Numerical Investigation of the Effect of the Co-Combustion of Hydrogen and Natural Gas on Temperature and Carbon Emissions in Ceramic Furnace" *B. Kılıç, K. Bayramoğlu, S. Yılmaz, T. Bayramoğlu, A. Özarslan, A. Akbay* **#185** "Investigation of NO_x Reduction by NH_3-SCR in Aftertreatment System for H_2 Internal Combustion Engine" *T. B. Sarı, S. E. Bozbağ, D. Ş. Yıldız, C. Erkey* **#207** "Probative Assessment of Hydrogen Enriched Methane Induction in Gasoline Direct Injection Engine for Homogeneous Stoichiometric Lean Mixture Formation" *E. G. Varuvel, J. Stanley, L. J. Martin* **#302** "An Alternative Fuel for Afterburner: Energy and Economic Comparison for NH_3/H_2 and JP-8" *E. Oğur, A. Koç, H. Yağlı, Ö. Köse, Y. Koç* **#311** "CFD-Based Thermal and Emission Analysis of a 2D Hydrogen-Fueled Combustor Using Real Engine Data at Cruise Altitude" *Y. F. Görgülü, S. Ekici, T. H. Karakoc* **#312** "Combustion and Emission Behavior of a Hybrid Ammonia–Jet-A Blend Under Real Jet Engine Operating Conditions" *Y. F. Görgülü, S. Ekici, T. H. Karakoc*	**#40** "Use of Conventional and Renewable Energy in Türkiye's Hydrogen Supply Chain: A Grid-based Risk Assessment" *H. Kırış, M.G. Güler, Ö.N. Bilişik* **#213** "Type-2 Fuzzy MPPT Control of Fuel Cells Using a Hybrid Genetic-Grey Wolf Optimizer" *Ö. F. Özcan* **#214** "Hybrid Optimized Takagi Sugeno Type 2 Fuzzy-Based Voltage–Frequency Controller for Fuel Cell Integrated Isolated Microgrid" *Ö. F. Özcan, H. Kılıç, Ö. F. Özgüven* **#228** "Enhancing Longevity of Hydrogen-Powered Electric Vehicles, an Adaptive Neuro Fuzzy Control-Based High-Gain, Low-Stress Power Converter" *M. Özden, D. Ertekin, K. Baltacı* **#229** "Design and Implementation of Pseudo Levenberg-Marquardt Learning Artificial Neural Network Controller for Power Conversion in Fuel Cell to Battery Charging Systems, Improving Power Efficiency and Reliability" *M. Özden, D. Ertekin, K. Baltacı* **#261** "Sustainable Energy Based on Optimizing Load Frequency Control in Military Microgrid" *M. T. Özdemir, S. Çelikdemir, B. Yıldırım*	**#44** "Hydrogen Detection and Electrical Properties of Perovskite $BaTiO_3$ Schottky Diode" *L.B. Tasyurek, H. Karakurt, N. Kilinc* **#52** "Evaluation of Deformation via in situ SEM and EBSD on Hydrogen Embrittlement" *S.H. Nahm, H.S. Yun* **#127** "HAZOP and Fault Tree Analysis of Ammonia Leakage in a Ship's Ammonia Fuel System" *B. Zincir, B.A. Zincir* **#291** "Systematic Risk Analysis for Hydrogen Fuel Cell Vehicles and Safety Management in Fuel Cells" *N. Özaslan, B. Tanç* **#271** "SIC Schottky Diodes: Electrical Characterization and Gas Sensor Applications" *L. U. Kendirli, L. B. Taşyürek, N. Kılınç*

Coffee Break (with Poster Session-2)

LUNCH *(Lokal Çatı Restaurant, Dokuz Eylul University Rectorate)*

EXHIBITION

SCIENTIFIC PROGRAM

Tuesday – May 27, 2025

PARALLEL SESSIONS – 4

	HALL A	HALL B
14.00 16:00	**SPECIAL SESSION** **Membrane Technologies in H_2 Production, Separation, and Utilization - II** **Session Chairs: A. Iulianelli & C.O. Colpan**	**Session 15. Fuel Cells and Applications – II** **Session Chair: İnci Eroğlu**
	Giuseppe Barbieri *National Research Council – Institute on Membrane Technology, Italy* **Lecture 5: Revolutionizing Syngas and Biogas Valorization: Advanced Membrane Gas Separation for CO_2 and H_2 Recovery**	**Sarp Kaya** *Koç University* **Koç University Hydrogen Technologies Center (KUHyTech): Pioneering Sustainable Innovation for the Future**
	Simona Liguori *Clarkson University, United States* **Lecture 6: Engineering a Paradigm Shift in How We Think About Reactors: Metallic Membranes for Highly Intensified Hydrogen Production**	**#12** "Development of Operation Strategies for Improving Polymer Electrolyte Membrane Fuel Cell System Water Management and Hydrogen Circulation" *J. Bae, H. Park, I.J. Son, S. M. Park* **#24** "A-site Deficient $La_{0.4}Ca_{0.4}Ti_{0.995}Pt_{0.005}O_3$ with Low Pt Substitution as an Oxygen Reduction Electrocatalyst for Fuel Cell Applications" *S. Ozkan, S.Kim, J.T.S. Irvine* **#32** "Analysis of $MgCr_{2-x}Mn_xO_4$ (X=0.1/0.5/1) Spinel and LSM Composite Coatings as a Protective Layer for SOFC Interconnect" *H. Unsal, C.D. Savaniu, J.T.S. Irvine* **#102** "Experimental Analysis of Reversible Solid Oxide Cells Performance Degradation from Varying Power Ratios and Switching Frequencies in Operation" *N. Ali, G. Loreti, D. Pumiglia, Y.De Pra, L.D. Seta, V. Cigolotti, G. Monteleone, D. Borello* **#109** "Investigation of LSC-Based Composite SOFC Cathode Layers by ESD Coating Method" *E. Erğen, S. Akkurt* **#233** "Investigation of Carbon Felt Fabric as a Gas Diffusion Layer in PEM Fuel Cells: Stability and Coating Capability" *A. Şirin, J. H. Özdemir, O. K. Özdemir, N. Alp, M. Alp, E. Akarsu* **#234** "Investigation of Fuel Cell Performances by Recycling Used Membranes" *B. Aktaş, O. K. Özdemir, J. H. Özdemir*
	Gabriel Bernardo *University of Porto, Portugal* **Lecture 8: Carbon Molecular Sieve Membranes for the Purification of Hydrogen**	
	#63 "Synthesis, Characterization of MOFs, and Evaluation as Adsorbents in Hydrogen Purification" *Z. Bilgin, D. Dumlu, N. Ayas* **#4** "Optimization of Green Hydrogen Electrolyser Plant Efficiency and Required Power Quality Solution" *T. Aydın, H. Bezerra* **#11** "The Potential of Offshore Wind Farms as Hydrogen Fuel Station: A Case Study of Marmara Sea" *V. Dixit, C. Acar*	
16:00 16:30	**Coffee Break (with Poster Session-3)**	

SCIENTIFIC PROGRAM

Tuesday – May 27, 2025

PARALLEL SESSIONS – 4

HALL C

Session 16. Catalysts for Hydrogen Applications – III

Session Chair: Tsong-pyng Perng

#163 "NASICON ($Na_3NiCo_2(PO_4)(SO_4)_2$) Doped Polyaniline as a New Candidate Electrocatalyst in Hydrogen Evaluation Reaction" *S. M. Yılmaz, A. K. Figen*

#181 "Development of Ce-Promoted Ni-Based Methanation Catalysts for Enhanced CH_4 Production" *B. Acar, B. S. Çağlayan, A. E. Aksoylu*

#182 "A Mechanistic Drifts-MS Investigation and Active Intermediate Determination of DRM at Low Temperature over Ru-La/ZrO_2 Catalyst" *O. Ordulu, A. Uzun, C. Öztepe, B. M. Eropak, B. S. Çağlayan, A. E. Aksoylu*

#183 "Operando Drifts Investigation of Active Intermediates in CO_2 Methanation over Ni-La/γ-Al_2O_3 Catalysts Under Low H_2/CO_2 Feed Ratios" *C. Öztepe, O. Ordulu, A. Uzun, B. M. Eropak, B. S. Çağlayan, A. E. Aksoylu*

#74 "Shaped Ni/Mesoporous CeO_2 as Active Catalysts in Hydrogen Production from Acetic Acid Oxidative Steam Reforming" *Á.M. de la Calle, A.J. Vizcaíno, A. Carrero, J.A. Calles, P.J. Megía*

#154 "Preparation of Zinc and Cobalt with Boron Doped Nickel Electrodes for Alkaline Electro-catalytic Hydrogen Production Activities" *A.D. Tümer, C. Demir, B. C. Filiz*

#226 "High-Entropy $NiCoCuFeMoMnO_x$ Oxide Thin Films Deposited via Open-Air Pulsed Laser for Efficient Electrocatalytic Oxygen Evolution Reaction" *H. Mahdavi, A. A. Alamdari, U. Ünal, H. Jahangari*

HALL D

Session 17. Hydrogen Economy, Infrastructure, and Policy – I

Session Chair: Emrah Erginer

#83 "Hydrogen Fuel Viability in EU Maritime Transport with Emissions and Policy Implications" *B.A. Zincir, B. Zincir*

#97 "Planning And Managing Renewable Gas Integration in the Portuguese Natural Gas Network" *F. Machado, L. Fernandes, L. Marcon*

#155 "Design of a Future Hydrogen Supply Chain Under Carbon Emission Constraints: The Case Study of Central Anatolia" *T. Ulusoy, A. Döyen, M.G. Güler*

#173 "Impact of Transportation Constraints on Hydrogen Supply Chain Performance of Türkiye" *B. Türkali-Özbek, A. Erdoğan, M. G. Güler*

#227 "The Role of Hydrogen Energy in Net Zero City Strategies" *M. T. Balta, M. Ö. Balta*

#256 "A Comparison of Systemic Performance: The Framework Models of Hydrogen Strategies in (Inter)National Energy Policies for Clean Energy Transition" *E. Gürler, A. Gürler Akdeniz, Y. Ateş, A. R. Boynueğri*

#356 "A Novel Framework of Synergistic Hydrogen City Design for Urban Decarbonization and Net-Zero Energy Autonomy" *A. Abu-Rayash*

HALL E

Session 18. Gasification and Reforming Technologies

Session Chair: Eileen Yu

#73 "Hydrogen from Bio-oil: Thermodynamic Insights on Steam Reforming Technologies" *P.J. Megía, C. Rocha, A.J. Vizcaíno, A. Carrero, J.A. Calles, L.M. Madeira, M.A. Soria*

#87 "Steam Reforming of Sugar Beet Pulp with Dolomite-Based Ni-La Catalyst" *S. Karadeniz, .K. Kanatlı, N. Pourmoghadam, Ş. Genç, S.M.A. Aljafreh, N. Ayas*

#195 "In Situ Characterization of Pt-Re-Na/CeO_2 System and Operando Analysis of WGS Mechanism on its Sites by FTIR-DRIFTS-MS" *B. M. Eropak, A. Uzun, B. S. Çağlayan, A. E. Aksoylu*

#215 "Transfer Learning from Steam and Dry Reforming of Methane to Tri-Reforming of Biogas for Syngas Production" *R. Yıldırım, A. Coşgun, M. E. Günay*

#248 "A Simulation Study for Hydrogen Production from Low Rank Turkish Lignite Through Gasification in Trijen Pilot Plant in Soma" *Ö. O. Er, G. Kavas, M. Ünsal, A. S. Kartay, N. Ünlü, E. Muşdu, Ö. Ataç*

#259 "Thermal Modelling of Autothermal, Steam, and Partial Oxidation Solid Oxide Fuel Cell Reformers" *M. T. Çoban, H. Genceli, M. Asker, O. E. Turgut, M. S. Turgut*

#294 "Experimental and Theoretical Study of an Active Ni Nanocatalyst for the Hydrolysis of Sodium Borhydride and Dimethylamine Borane" *E. Karabulut, M. S. İzgi, E. Onat, S. Faal, F. A. Çelik, Ö. Şahin*

#347 "Sewage Sludge and MSW Gasification for Hydrogen Production: Integrating Renewable Energy with Desalination and Agriculture" *O. Tezer, A. Ayol*

EXHIBITION

Coffee Break (with Poster Session-3)

SCIENTIFIC PROGRAM

Tuesday – May 27, 2025

PARALLEL SESSIONS – 5

	HALL A	HALL B
16:30 18:30	**WORKSHOP** **Innovations on Hydrogen-based Processes & Technologies** **Session Chair: Adolfo Iulianelli & Canan Acar**	**Session 19. Electrolysis and Electrolyzer Technologies – I** **(Sponsored by ARMELSAN Energy)** **Session Chair: Mustafa Kaan Baltacıoğlu**
	Alberto Figoli *National Research Council – Institute on Membrane Technology, Italy* **Operational Plan for Hydrogen Research, POR H_2 – EU/ NextGeneration EU – Program Agreement MASE/ENEA PNRR**	**#78** "Dynamic Modeling of an Anion Exchange Membrane Electrolyser" *S. Obut* **#305** "Electrolysis-Based Hydrogen Production Using Coaxial Cylindrical Electrodes with a Scrubber-Wire Cathode" *D. Erdemir, A. Y. G. Kara, I. Dincer* **#144** "Enhanced PEM Water Electrolysis with Low Equivalent Weight Aquivion® Membranes" *F. Giacobello, S. Siracusano, M.A. Mancuso, V. Cicciò, A. Muscolino, A.S. Aricò* **#90** "Green Hydrogen Production through AEM Electrolysis Technology" *V. Cicciò, S. Siracusano, S.C. Zignani, M. Pascale, A.S. Aricò* **#91** "MOS_2-Based Catalyst for Hydrogen Production in PEM Electrolysis" *M.A. Mancuso, S. Siracusano, F. Giacobello, V. Cicciò, A. Muscolino, A.S. Aricò* **#100** "Rapid and Scalable Synthesis of 3D Gas Diffusion Electrodes for AEM Water Electrolysers" *F. Lisi, R. Viscardi, I. Gualandi, E. Scavetta, F. Mariani, A. Fasolini, F. Basile* **#120** "Text-mining and Bibliometric Analyses for Proton Exchange Membrane Electrolyzers" *A. Fırtın, A. Yılmaz, İ. Eroğlu, R. Yıldırım, D. Eroğlu* **#130** "Synthesis of New Polystyrene Based Anion Exchange Membrane for Alkaline Electrolyzer" *L. Başat, M. Farsa, G. Kardaş*
	Jan Veres *Technical University of Ostrava, Czech Republic* **Research Excellence for Region Sustainability and High-Tech Industries, REFRESH – International Project**	
	Antonio Agresta *National Agency for New Technologies, Energy and Sustainable Economic Development, Italy* **Driving Innovation Towards Future Aviation with Cutting-Edge Refuelling Technologies and Processes ALRIGH2T – EU Project**	
	Krzysztof Kapusta *Clean Coal Technology Centre – Centre for Climate and Renewable Energy Research, Poland* **Development of H_2 Oriented Municipal Waste Refinery Based on a Novel Borehole Gasification Process Combined with Advanced Gas Separation Techniques, HYDROMINE – EU Project**	
	Alessandra Beretta *Politecnico di Milano, Italy* **EMERALD – A Novel Electrified Reactor with Radial Current and Flow for the Intensification of Endothermic Catalytic Processes** **Research Project Funded by Air Liquide**	
19:00 21:00	**Banquet** *(Lokal Çatı Restaurant, Dokuz Eylul University Rectorate)*	

SCIENTIFIC PROGRAM

Tuesday – May 27, 2025

PARALLEL SESSIONS – 5

HALL C

Session 20. Hydrogen Storage Systems – I

Session Chair: Tugba Akkas Boynuegri

#6 "Numerical Study of Novel Thermal Management Methods for Hydrogen Storage in a Metal Hydride Reactor" *F. Selimefendigil, G.Şenol, H.F. Öztop*

#16 "FEM Based Numerical Study of Hybrid Nanofluid Enhanced Hydrogen Absorption in a Metal Hydride Reactor" *F. Selimefendigil, G. Şenol, H.F.* Öztop

#35 "Statistical Analysis of Hydrogen Storage on Boron Materials via Machine Learning" *A. Stif, E.C.Özcan*

#116 "Influence of the Technology for Obtaining IMC of the Mg-7%Ni-3%Ce System on the Evolution of Phase Transformations" *N. Ukhamedova, A. Miniyazov, Z. Ospanova, A. Sabyrtaeva, K. Shaikieva*

#118 "Integrating Metal Hydride-based Hydrogen Storage Tank with a PEM Fuel Cell Stack for Enhanced Energy Efficiency in Underwater Applications" *B. Sezgin, T.Öztürk, İ. Eroğlu*

#122 "Role of Hydrogen Adsorption and Desorption in Underground Storage within Coal Seams" *Ö. İmir, Ş. Merey, A. Fişne*

#158 "Optimization of Assembly Torque and Lubrication Amount for Hydrogen Tank Valves" *O. Özkan*

#322 "Production and Characterization Sulfonated Polyphenyl Sulfone PEM Membrane for Vanadium Redox Battery" *E. Çolak, S. Kahraman, B. Çetin, D. Ünlü, F. Ugur Nigiz*

HALL D

Session 21. Renewable Hydrogen Technologies and Integration

Session Chair: Anıl Erdoğan

#8 "Solar Thermochemical Hydrogen Generation with a 250-kW Structured Reactor: Experiences from Tests at the Jülich Solar Tower" *T. Fend, V.K.Thanda, J. Lampe, S.Menz, S.Schmitz, G.Piesche, S.Berger*

#50 "Securing Geothermal Energy Projects: Hydrogen Production and Underground Storage as a Solution for Electricity Market Fluctuations" *H. Aydın, S. Merey*

#77 "AI-Based Optimization of a PV-Battery-Electrolyzer System for Green Hydrogen Production" *A. Yılmaz, N. Aksoy, G. Bayrak*

#236 "The Evaluation of Renewable Energy Alternatives in Hydrogen Supply Chain in Türkiye Using Hybrid Fermatean Fuzzy AHP-WPM Approach" *H. Kırış, Ö. N. Bilişik*

#202 "Thermodynamic Evaluation of Hybrid Thermochemical Process for Lignin to Hydrogen and Methane Conversion" *S. Yadav, F. Khalid*

#201 "Thermodynamics Assessment of a New Three-Step Cycle for Methane to Methanol and Hydrogen Production" *V. Yadav, I. Khan, F. Khalid*

#306 "An Experimental Investigation for Improved Hydrogen Production from Magnesium-Seawater Reaction" *Y. Hafez, I. Dincer*

#307 "Application of Synthesized Ammonium Formate as an Electrolyte in Stainless Steel-Stainless Steel Electrode H-Cell Configuration" *C. G. Turk, I. Dincer*

HALL E

Session 22. Hydrogen Use in Industrial Applications

Session Chair: Ismail Ekmekci

#133 "Optimizing Energy Investments for Growing Demand of Türkiye: Hydrogen-Based Batteries and Renewable Integration" *A.O. Kabil, M.G. Güler*

#232 "Designing a Multiple Production System Based on CO_2 Capture and Utilization in Glass Industry" *I. Akgun, I. Dincer*

#281 "Theoretical Investigation of Using of Hydrogen and Natural Gas Blending in Slab Tundish Heating Systems for Green Steel Revolution" *H. T. Arat, M. K. Baltacıoğlu, S. M. Has*

#358 "Solar-based Green Hydrogen Production for Decarbonizing Natural Gas: An Emissions Perspective" *Habip Şahin*

#206 "Utilization of a Boron Co-Doped Activated Carbon/Starch Based Metal-Free Biocathode for Hydrogen Production" *A. T. Goren, I. Dincer*

#199 "Activated Charcoal for Sustainable Solid State Hydrogen Storage by Physical Adsorption" *A. Capoglu, I. Dincer*

EXHIBITION

Banquet

(Lokal Çatı Restaurant, Dokuz Eylul University Rectorate)

SCIENTIFIC PROGRAM

Wednesday – May 28, 2025

PARALLEL SESSIONS – 6

08:30 08:45	**Conference Registration**	
	HALL A	**HALL B**
08:45 10:45	**Session 23. Hydrogen Economy, Infrastructure and Policy – II** **(Sponsored by ARMELSAN Energy)** **Session Chair: Jan Veres**	**Session 24. Hydrogen Vehicles and Mobility – II** **Session Chair: Antonio Vita**
	Invited Speaker **Tareq Al-Ansari** *Qatar Environment and Energy Research Institute* **Role of Hydrogen in the Energy, Water and Food Nexus**	**#188** "Comparative Life Cycle Carbon Emissions Assessment of Utilizing Diesel Oil and Hydrogen Fuel on a Ferry" *O. Konur, M. E. Aydın, M. S. Aydın* **#204** "High Voltage Gain LLC Resonant Converter Design for Energy Transfer from Fuel Cell Electric Vehicle to Electric Vehicle" *M. Akkuş, E. Akboy, A. R. Boynueğri* **#211** "Investigation of T-Class Fuel Cell Hybrid Electric Off-Road Vehicle" *Z. S. İşleyen, M. U. Karaoğlan* **#221** "Performance Analysis of a Small Hybrid Vehicle on Inclined Roads Under WLTP Class 2 Drive Cycle" *B. Yılmaz, C. O. Colpan* **#225** "Uninterrupted Communication with PEMFC-Enhanced UAVs in Disaster Scenarios" *M. Kayaoğlu, S. Unal, B. Calisir* **#251** "Design of a Standalone Electric Vehicle DC Fast Charging Station Based on a Hybrid Energy System with Fuel Cell and PV for a Tourist Resort" *M. Yıldırım, S. Unal* **#314** "Numerical and Experimental Investigation of Electric and Fuel Cell Hybrid Mini UAV" *İ. Sağlam, Z. İşleyen, M. Karaoğlan, Ş. Yavuz* **#174** "Mathematical Modeling and Ground Tests of a Fuel Cell Hybrid Unmanned Aerial Vehicle in Cruise Phase" *M. Azer, M. U. Karaoğlan, C. O. Colpan, T. H. Karakoc*
	#359 "A Policy on H_2/SAF Valley in Türkiye" *A. Midilli* **#255** "Hydrogen Value Chains in Positive Energy Districts: A Multi-Level Analysis on the Dynamics between Energy Transition Plans and Integrated Spatial Planning" *A. Gürler Akdeniz, E. Gürler, Y. Ateş, A. R. Boynueğri* **#253** "Critical Path Analysis for a Future Hydrogen Supply Chain: A Case Study for Central Anatolia" *M.G. Güler, T. Ulusoy, A. Döyen, F. Kosanoğlu* **#265** "Optimizing Hydrogen Refueling Infrastructure in Qatar: A Maximum Coverage Location Model Approach" *C. Méndez, R. Baldacci, M. Contestabile, Y. Bicer* **#310** "Techno-Economic Analysis of Green Hydrogen Production: Investigating Hybridization Potential in İzmir" *E. D. Gülay, C. O. Colpan, M. A. Ezan*	
10:45 11:05	**Coffee Break (with Poster Session-4)**	

SCIENTIFIC PROGRAM

Wednesday – May 28, 2025

PARALLEL SESSIONS – 6

Conference Registration

HALL C	HALL D	HALL E
Session 25. Fuel Cells and Applications – III **Session Chair: Adele Brunetti**	**Session 26. Thermodynamics of Hydrogen Energy Systems** **Session Chair: Aysel Kantürk Figen**	**Session 27. Sustainable Hydrogen Technologies – II** **Session Chair: Ivana Perović**
#125 "Development of Flat-Tubular Solid Oxide Fuel Cells via Mold Casting" *K. Bilgil, Ç. Timurkutluk, S. Onbilgin, B. Timurkutluk* **#129** "Microtubular Solid Oxide Fuel Cells with Ytterbium Doped Zirconia Electrolytes" Ç. Timurkutluk, E. Yıldız, *G. Germen Tutaş, S. Onbilgin, B. Timurkutluk* **#132** "Lightweight and Optimized End Plates for PEM Fuel Cells: A Comparative Structural Analysis" *F. Çetiner, A.E. Kılıç, S. Çelik, S. Toros, R.E. Ece* **#142** "Developing and Designing Different Channel Types for Micro Direct Methanol Fuel Cells Based on Mitochondria Cell Structure" *M. Menteş, A.E. Kılıç, S. Çelik, F.D. Güzel, M.K. Birhanu* **#157** "Scale up Techniques for PEMFC: Fluid Mechanics Approach" *G. Tol, A.C. Türkmen, C. Çelik, F.G. Boyacı San* **#212** "Impact of Current Density on Temperature and Water Content Distribution in a PEM Fuel Cell using a Coupled Heat and Mass Transfer Model" *M. Jahanbakhsh, E. Aydın, C. Erkey* **#230** "Optimized Event-Triggered Control for Enhancing Solid Oxide Fuel Cell Performance and Stability" *H. Kılıç, İ. Poyraz, M.E. Asker*	**#5** "Efficiency and Performance Analysis of IT-SOFC Integrated with S-CO_2 Brayton Cycles: A Comprehensive Study on Waste Heat Utilization" *S. Beygül, Y. Kalıncı* **#197** "Thermodynamic Analysis of Synthetic Fuel Production from Carbon Dioxide Obtained from Carbon Capture Facility in Oil Refinery by Combination of Hydrogen Production and Power Conversion" *S. B. Sungur, E. Kayabasi, E. Alp* **#198** "Analysis of Synthetic Fuel Production Utilizing the Waste Heat from Blast Furnace Hot Stoves by Combination of Thermal Energy Storage and Power Cycle" *S. B. Sungur, E. Alp, E. Kayabasi* **#192** "Performance Assessment of Hydrogen Production from Geothermal-Solar Based ORC System" *Y. N. Atak* **#208** "Thermodynamic Modeling of an Innovative Integrated Polygeneration System Using Sustainable Energy Resources" *M. A. Sabbaghi, C. O. Colpan, H. Genceli* **#330** "Green Hydrogen Production Station: Applying Exergetic Sustainability Parameters to a 1 MW PEM Electrolyzer" *A. E. Aluç, A. Midilli* **#308** "Mathematical Modeling and Simulation of an Anion Exchange Membrane Water Electrolyzer Using COMSOL Multiphysics" *A. Demirtaş, C. O. Colpan, Y. Devrim, Y. N. Atak* **#141** "Thermodynamic and Electrochemical Modeling of Direct Methanol Fuel Cell System for Portable Applications" *E. Kalkan, M. Alobeid, S. Çelik, H. Özcan*	**#333** "An Efficient and Sustainable Approach to Green Hydrogen Production Using PV Systems" *H. Topcan, A. Akpolat, U. Aydemir* **#343** "Hybrid Hydrogen Systems for Mitigating Sub Synchronous Oscillations in Weak Power Grids" *S. Shahzad, H. Kilic* **#313** "Boosting Photocatalytic Hydrogen Production through Ni_2P/g-C_3N_4/Ti_3C_2 Quantum Dots" *D. Akyüz, B. Güven, E. Demirbaş* **#338** "Metal-organic Frameworks for Hydrogen Storage" *S. Demir* **#283** "Manta Ray Foraging Optimization for Accurate Parameter Estimation of Proton Exchange Membrane (PEM) Fuel Cell Model" *D. Yağcı, H. Genceli, O. E. Turgut* **#89** "Plasma-catalytic Method of Methane Conversion in Microwave Discharge" *M. Skakov, A. Miniyazov, T. Tulenbergenov, I. Sokolov, A. Agatanova* **#151** "Speed Control of a Synchronized Induction Motor Powered by Hydrogen Fuel Cell" *H. Erdoğan*

Coffee Break (with Poster Session-4)

EXHIBITION

SCIENTIFIC PROGRAM

Wednesday – May 28, 2025

PARALLEL SESSIONS – 7

	HALL A	HALL B
	PANEL **Hydrogen Technologies in the Defense Industry**	**Session 28. Electrolysis and Electrolyzer Technologies – II** **Session Chair: Gülfeza Kardaş**
11:05 12:50	**Moderator** **Selmiye Alkan Gürsel** *Sabancı University, Türkiye* **PANELISTS** **Deniz Demirci** *Secretariat of Defense Industries (SSB), Türkiye* **Hüseyin Devrim** *TEKSIS, Türkiye* **Uğur Kayasal** *Roketsan Missiles Inc., Türkiye* **Devrim Köseoğlu** *Turkish Aerospace Industries (TUSAŞ), Türkiye* **İbrahim Pamuk** *LENTATEK, Türkiye* *This panel aims to provide insights into how hydrogen can revolutionize military propulsion systems, enhance energy resilience, and support sustainable logistics.*	**#138** "Synthesis of NiFeMo HER Catalyst on Nickel Foam for AEM Electrolyser" *Y.S. Adam, M. Farsak, G. Kardaş* **#166** "Simulation-Based Performance and Cost Optimization of Alkaline Electrolysers" *S. Ş. Demirezen, H. Özcan, S. Çelik* **#168** "Comparison of IrO_2-FeVS and IrO_2-FeVS-Co Catalysts in PEM Electrolysis at Different Temperatures" *M. Çokyaşa, A. Ekinci, Ö. Şahin, O. Baytar* **#243** "Experimental Analysis of Proton Exchange Membranes for Water Electrolyzers Across a Range of Operating Parameters" *A. Albadwi, S. B. Selçuklu, M. F. Kaya* **#48** "Optimization of Boron-doped Nickel Electrodes for Enhanced Hydrogen Production via Alkaline Electrolysis" *C. Demir, K.A. Uğurlu, D. Türkyılmaz, A.D. Tümer, B.C. Filiz* **#139** "Investigation of Long-term Degradation Effects in PEM Electrolyzers" *A. Çankaya, S. Çelik, B. Sevinç, K. Dağıdır, H. Özcan* **#148** "Design of Single Porous Transport Layer with Strut-based Lattice Structures for PEM Electrolyzers" *K. Dağıdır, A. Çankaya, S. Çelik*
12:50 13:30	**LIGHT LUNCH** *(Foyer)*	
	KEYNOTE SESSION 3 (HALL A) **Session Chair: Azize Ayol**	
13:30 14:10	**Feridun Hamdullahpur**, *University of Waterloo* **Green Ammonia: A Pragmatic Pathway for Early Green Hydrogen Commercialization**	

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PARALLEL SESSIONS – 7

HALL C	HALL D	HALL E	
Session 29. Hydrogen Storage Systems – II **Session Chair: S. Aykut Korkmaz**	**Session 30. Sustainable and Renewable Hydrogen Technologies** **Session Chair: David Alique**	**Session 31. Biohydrogen and Waste-to-Hydrogen** **Session Chair: Krzysztof Kapusta**	
#126 "Geological Hydrogen Storage for Long-duration Energy Resilience" *A. Özmumcu, A. Baba* **#180** "Performance Assessment of a Hybrid Compressed Air Energy Storage System Fed by Hydrogen from RES" *V. Tola, R. Caria* **#239** "Fly Ash-Derived Supported Iron Catalysts for Efficient Ammonia Decomposition: A Sustainable Approach for CO_x-free Hydrogen Storage" *B. Sekizkardeş, S. F. Kurtoğlu-Öztulum* **#361** "Intelligent Health monitoring of Hydrogen Storage and Transport Systems" *S. Sikdar*	**#298** "Sustainable Hydrogen Production Through Hybrid Nanofluid Integrated Evacuated Tube Solar Collectors with Organic Rankine Cycle" *S. G. Güngör* **#346** "From Agricultural Waste to Renewable Energy: Integration of Soil-based Microbial Fuel Cells in Biobed Systems for Sustainable Treatment of Olive Oil Mill Wastewater" *S. Gunes, A. Ayol* **#316** "Producing Hydrogen and Heat from Solar Towers: A Path toward Energy-Independent Cities" *E. Kocaman, H. Yağlı, H. Tutumlu, E. Oğur, R. Yumrutaş* **#106** "Investigation of the Conditions for the Use of New Generation Hydrogen Generator in Geothermal Power Plants: Kizildere Geothermal Field Case Study" *R. Ş. Çetin, F.G.Boyacı San, F. S. T. Haklıdır* **#334** "Hydrogen Production from NaCl, $CaCl_2$ and $MgCl_2$ Salts using Carbon Rods Extracted from Waste Batteries" *S. Damarseckin, M. Erden, A. Atiz, H. Karakilcik, M. Karakilcik* **#366** "Development and Analyses of a Nuclear-Driven Polygeneration System with Helium Brayton Cycle, Hydrogen and Ammonia Production, Ejector Cooling, and Desalination" *O. Kizilkan, G. Soytürk*	**#42** "Comparative Analysis of Biohydrogen Production Studies in Türkiye Using Evidence Synthesis Methodology" *K.K. Yiğit, T. Keskin-Gündoğdu* **#43** "Evaluating the Performance of Boosting Regressors for Predicting Biohydrogen Production under Variable Experimental Conditions" *M.A. Ergün, T. Keskin-Gündoğdu, B.E. Köktürk- Güzel* **#99** "Evaluation of Hydrogen Production Efficiency by Dark Fermentation Process of Various Airport-derived Wastes" *F. Altay, N. Semerci, A. Öngen, Ş. Duran, M.C. Altay, N. Yeşilova* **#219** "Challenges and Limitations of Dark Fermentative Hydrogen Production" *Ş. Arıcı, G. Koçar* **#220** "Integration of Dark Fermentation and Microbial Electrolysis Cells for Hydrogen Production from Wheat Straw" *Y. D. Yilmazel, İ. Konar, R. Kunayeva, İ. Bulat, R. Harb* **#345** "Comparative Assessment of Bioelectricity Generation from Various Industrial Wastewaters and High-strength Organic Wastes Using Microbial Fuel Cell Technology" *I. Biryol, A. Ayol* **#79** "Enhanced Catalytic Performance of Titanium Dioxide-supported CuCo Bimetallic Catalyst for Hydrolysis of Ammonia Borane" *M. Kılıç, E. Özdemir*	**EXHIBITION**
LIGHT LUNCH *(Foyer)*		**Optional Social Tour (starts at 12:30)**	

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Wednesday – May 28, 2025

14:10 14:30	**NHA AWARDS CEREMONY & REMARKS (HALL A)**	
	PARALLEL SESSIONS – 7	
	HALL A	**HALL B**
14:30 16:30	**Session 32. Catalysts for Hydrogen Applications – IV** **Session Chair: Hadi Genceli**	**Session 33. Sustainable Hydrogen Technologies – III** **Session Chair: Canan Acar**
	#23 "Development of Fe-C Microwave Catalysts for Conversion of H_2S into CO_x-free H_2" *Y. Ataseven, M.Y.Doğan, S.Yaşyerli, H.Arbağ, H.M.Taşdemir, N.Yaşyerli* **#29** "Ultrasonic Spray Synthesis of Coal Layered Double Hydroxide: A Novel and Scalable Approach to Oxygen Reduction Catalysis" *K. Büyükkanber, Ö. Şahin* **#66** "Synthesis of Ru/C and PtRu/C Catalysts by Microwave-Assisted Polyol Method at High Temperature and Pressure" *S. Karadeniz, N. Ayas* **#69** "Microwave Assisted Methane Decomposition Reaction Using Nickel-palladium Catalysts Supported on Different Carbon Supports" *R.C. Seyfeli, D. Varisli* **#119** "Preparation of Pd/Ni Foam Catalyst and Its Catalytic Performance for Hydrogen Production by Hydrolysis of Ethylenediamine Bisborane Solution" *O.S. Angı, G. Özkan, G. Özkan* **#274** "Understanding of the Activity of NiFe Oxide Based OER Catalysts Toward Mesoporous NiFe Oxide Thin Films" *A. E. Başaran, C. Karakaya, N. Solati, S. Kaya* **#370** "Development of Innovative Catalysts for AEM Electrolyzers Through Various Electrodepotions Techniques" *E.S. Akyüz, Ö. Aydın, B. Hüner, E. Telli, M. Farsak*	**#46** "Trends and Insights in Hydrogen Energy: A Bibliometric Approach" *N. Ersoy, İ. Ekmekci* **#189** "Hydrogen Production from Wastewater of Domestic Heat Pump Based Tumble Dryers: An Innovative Approach for Sustainable Energy" *A. Erdogan, A. Basdemir* **#28** "Modeling the Economic Viability of Integrated Hydrogen Fuel Cell / Heat Pump CHP Systems for Residential Applications" *F. van der Laan, C. Acar, W Rohlfs* **#167** "Effect of Temperature and Cathode Flow Rate on Performance of Hydrogen-Bromine Redox Flow Battery" *A. C. Turkmen, C. Celik, F. G. B. San* **#194** "Development of Membranes for Hydrogen Bromide Redox Flow Batteries" *K. C. Ata, A. C. Türkmen, F. G. B. San, C. Çelik* **#360** "The Effect of Earthquakes on Underground Hydrogen Storage Caverns" *H. Karakilcik* **#164** "Green Synthesis of MnVS and Co-Doped MnVS Nanoparticles: Applications in Photocatalysis and Hydrogen Production via Methanolysis" *M. Çokyaşa, Ö. Şahin, A. Ekinci, O. Baytar*
16:30 16:45	**CLOSING REMARKS (HALL A)**	

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Wednesday – May 28, 2025

NHA AWARDS CEREMONY & REMARKS (HALL A)

PARALLEL SESSIONS – 7

HALL C	HALL D	HALL E
Session 34. Hydrogen Carriers – II **Session Chair: Özgün Tezer**	**Session 35. Modeling, Simulation, and Optimization – II** **Session Chair: Yağmur Nalbant Atak**	**Session 36. Electrolysis and Electrolyzer Technologies – III** **Session Chair: Olgun Konur**
#25 "Investigating the Superior Effect of g-C_3N_4 on Co-B Catalysts for Efficient Hydrogen Generation via $NaBH_4$ Hydrolysis" *B.C. Çelik, H.Elçiçek* **#47** "Cobalt-copper-boron Doped Graphitic Carbon Nitride as a Promising Catalyst for Hydrogen Production Via Sodium Borohydride Hydrolysis" *Ö. Şahin, F.E.G. Güner, M.E. Kenar* **#348** "Hydrogen-rich Syngas for Cold Chain Logistics: A Life Cycle Assessment of Biomass Gasification Integration" *M. U. Ozturk, A. Ayol* **#104** "Catalytic Potential of g-C_3N_4 in $NaBH_4$ Hydrolysis: A Scientometric Study on Hydrogen Production" *B. Yılmaz, B.C. Çelik, H. Elçiçek, A.S. Karakurt* **#117** "Maximizing the Degree of Dehydrogenation of Perhydro-dibenzyl Toluene via in-line Distillation for Continuous Hydrogen Release" *M. Naseem, M. Luqman, Y. Biçer* **#301** "Advancements and Challenges in Liquid Hydrogen Storage Tank Design for Maritime Applications: A Comprehensive Review" *S. A. Çetinkaya, S. A. Korkmaz, N. Bimbo, S. Afshan* **#332** "Effect of Thermal Conditions on a PV-AEMWE System Integrated with Metal Hydride Storage Tanks" *C. Celebi, M. Ezan, C. Colpan, Y. Devrim*	**#9** "Techno-economic Evaluation of Hydrogen's Role in Dutch Heating Networks: A Dynamic Modeling Approach" *A. Kaabinejadian, A.Pozarlik, C.Acar* **#94** "Simulation Tool for Techno-Economic Analysis of Renewable Hydrogen Production Plants" *F. Machado, H. Monteiro, L. Fernandes, L. Marcon* **#321** "Design and Analysis of a Wind-powered Hydrogen Production System for a Maritime Autonomous Surface Vessel" *S. A. Korkmaz, S. Balakrishnan, P. Manias, S. Turnock* **#337** "Numerical Simulation of High-Temperature Proton Exchange Membrane Fuel Cell Performance Using 3-D COMSOL Model" *M. Buyuk, Y. Nalbant Atak, Y. Devrim* **#367** "Design and Evaluation of Dual-Fluid Geothermal Cycles with tRC Topping and ORC Bottoming for Electricity, Hydrogen, and HDH unit" *O. Kizilkan, G. Soytürk*	**#324** "Solar Syngas Production via a ZnO/Zn Based Carbothermal Reduction and Water Splitting Cycle" *R. Bhosale* **#279** "Investigation on Performance of Anion Exchange Membrane Electrolyzer with Different Flow Field Configurations" *U. Ergin, A. B. A. Ibrahim, S. Tumse, G. M. Ozkan, G. Kardas, H. Akilli* **#172** "Techno-Economic Analysis of MoS_2/Carbon Composites as Sustainable Platinum Alternatives in PEM Electrolyzer Cathodes" *H. Sarıaltın* **#352** "A Comparative Study on the Hydrogen Production Efficiency of Various Membranes in a Chlor-alkali Electrolyzer" *S. Damarseckin, E. Durar, M. Karakılçık, A. Atiz, H. Karakılçık* **#128** "Fluid Flow of Alkaline Water Electrolysis Hydrogen Cell: Design and Experimental Investigation" *M.A. Farahat, M. Abdelmordy, H.H. Eldeeb, A.M. Abdelsalam, W. A. El-Askary, I.M. Sakr* **#304** "Novel Cylindrical Electrolysis System with Copper-Coated Electrodes for Enhanced Hydrogen Production" *E. K. Oguz, I. Dincer* **#178** "Structural and Catalytic Insights into Sr-Modified $LaNi_{0.5}Mg_{0.5}O_3$ Perovskites" *P. Ebrahimi, A. Kumar, M. Al-Marr*	**EXHIBITION**

CLOSING REMARKS (HALL A)

SCIENTIFIC PROGRAM

Poster Session

Poster Sessions Chair: Olgun Konur

Poster Session – 1 (Monday – May 26, 2025 | 16:00 – 16:30)

#13 "Eco-friendly Leaching Strategies for Recycling Electronic Waste CPUs to Enhance Hydrogen and Oxygen Evolution" *S. Mitrović, S. Brković, M. Seović, M. Pijović Radovanović, P. Laušević, N. Zdolšek, I. Perović*

#14 "Electrochemical Surface Modification and Effects on the Catalytic Activity of Nickel-based Electrodes for Hydrogen Evolution" *S. Mitrović, S. Brković, M. Seović, P. Laušević, N. Zdolšek, Đ. Katnić, I. Perović*

#15 "Non-stoichiometric Tungsten-oxides as the Anode Catalyst Supports for PEM Fuel Cells" *S. Brković, I. Perović, M. Seović, S. Mitrović, P. Laušević, V. Nikolić, M.M. Kaninski*

#18 "Dual-doped Iron-copper Carbon Electrocatalyst for Enhanced Water Splitting Performance in Alkaline Media" *J. Georgijević, I. Perović, S. Brković, M. Seović, N. Zdolšek, J. Milikić, B.Šljukić*

#19 "Synthesizing Cost-effective, Dual-function Catalysts from Recycled CPUs and Lemon Peel for Water Splitting" *M. Seović, S. Brković, I. Perović, D. Jugović, J.M. Vukajlović, P.Laušević, S.Mitrović*

#21 "Life Cycle Assessment of Green Hydrogen Production via Electrolysis" *H. Camur, A. Isler-Kaya, F. Karaosmanoglu*

#22 "Development of Iron-Sulfide Catalysts for Green H_2 Production from H_2S" *N. Demirhan, H.Akansu, Y. Ataseven, M.Y.Doğan, S.Yaşyerli, H.Arbağ, H.M.Taşdemir, N.Yaşyerli*

#56 "Gasification of Agricultural Residual Biomass, Vector in the Production of Green H_2" *G.C. Lăzăroiu, L. Mihăescu, I. Pîșă, R.M. Grigoriu, D. Stoica, I. Simion*

#58 "Cost-effective Porous NiO/Ni@NF Nanosheet Catalysts for Hydrogen Production via Electrocatalytic Ethylene Glycol (EG) Oxidation" *S.A. Aladeemy, T.R.Al-Rijraji, M.S.Amer, P. Arunachalam, A.M. Al-Mayouf*

#60 "Results of Combustion Tests of H_2 – CH_4 Mixture with High H_2 Content" *L. Mihăescu Lucian, G. Lăzăroiu, A. Niculescu, D. Stoica, R.M. Grigoriu, M.G. Osman*

#61 "Ionic Liquid-enhanced Multifunctional Electrolytes for Hydrogen Evolution Reaction and Zn-based Batteries" *N. Zdolšek, A. Dimitrijević, I. Perović, S. Brković, M. Seović, P. Laušević, M.K. Roković*

#62 "Enhanced Electrochemical Performance of V_2O_5 Electrode with 1-butyl-3-methylimidazolium Salicylate Electrolyte for Hydrogen Evolution, Oxygen Evolution and Oxygen Reduction Reactions" *N. Zdolšek, A. Dimitrijević, I. Perović, S. Brković, M. Seović, M.K. Roković, M. Božiković*

#64 "Performance Analysis of Stand-alone Solar Systems in Coastal Environments: A Case Study" *M.G. Osman, G. Lazaroiu, C.V. Strejoiu, C. Panait, D. Stoica*

#65 "Increasing the Energy Efficiency and Economic Viability of a Photovoltaic Park in Craiova" *M.G. Osman, G. Lazaroiu, C.V. Strejoiu, C. Panait, D. Stoica*

Poster Session – 2 (Tuesday – May 27, 2025 | 10:30 – 10:50)

#80 "Synthesis and Characterization of Semiconductor Oxides CuO and ZnO for the Production of Green H_2 by Photo Catalysis under UV-visible Light" *N. Djamel, A. Samira, S. Farouk, F. Djawad, H.H. Aya*

#82 "Hydrogen Gas Production onto Fe_2O_3 and Clay/ Fe_2O_3 by Photo Chemical Conversion under UV-visible Light" *N. Djamel, A. Samira, S. Farouk, F. Djawad, H.H. Aya*

#88 "High-Value Carbon Production through Thermal Plasma Dry Reforming for E-fuel Viability" *A.R.C. Labanca, A.G. Cunha, R.P. Ribeiro, C.G. Zucolotto, M.B. Cevolani, M.A. Schettino Jr., F.G. Emmerich*

#92 "Innovative Electrolysis Using Non-Critical Raw Materials and Circular Economy Techniques to Improve Green Hydrogen Production" *A. Muscolino, A.S. Aricò*

#93 "A PEM Electrolyser with Low Precious Metal Loading" *V. Cicciò, S. Siracusano, A.S. Aricò*

#121 "Dehydrogenation of Dimethylamine Borane in the Presence of Ru^0/TiO_2 Catalyst" *A. Al-Areedheea, S. Karaboğa, İ.A. Morkana, S. Özkar*

#123 "Electrodeposition of Platinum on Electropolymerized ABA on Reduced Graphene Oxides as a Catalyst for Propanol Oxidation in Alkaline Solution" *P. Waenkaew, S. Sriwichai, S. Themsirimongkon*

#137 "Development of $NiCo(OH)_2$ Based OER Catalysis for Alkaline Water Electrolysis" *Y.S. Adam, G. Aksaray, E. Faki, M. Farsak, G. Kardaş*

#140 "Performance Analysis of Plant-Inspired Bipolar Plate Flow Channels for PEM Electrolysers using 3D Modelling" *M. Alobeid, S. Çelik*

#143 "Hydrogen Economy: Key Developments in China, Europe, and the USA" *D. Üngüder, A.C. Krutoff, M. Wappler*

#150 "The Role of Ammonia in Renewable Energy and Emergency Power Supply: A Feasibility Study" *H. B. Perçin, A. Çalışkan*

#152 "Exploring Hydrogen Mobility: A Feasibility Study on Sustainable Campus Transportation" *H. B. Perçin, A. Çalışkan*

#156 "Synthesis and Characterization of (Gd,Nd) – Doped $CeO_2/SrTiO_3$ Heterostructures for Lt-SOFC" *N. Kırkgeçit Aksoy, D. Kara, S. Kerli, M. Şaşmaz Güldal, O. Türkoğlu, H. Özlü Toru*

#159 "Seawater Electrolysis for an Advanced H_2 Production" *F. Giacobello, S. Siracusano, A. Muscolino, V. Cicciò, M. A. Mancuso, V. Antonucci*

#171 "Contribution of SM-Doped CeO_2 Nanoparticles to Hydrogen Production" *A. Kırkgeçit, H. Ö. Torun, N. K. Aksoy, M. Kisti, G. Özkırar, M. F. Kaya*

#175 "Development of Alkaline Electrolysis Catalyst Using Waste Zinc-Carbon Batteries" *H. Hançer, M. Farsak*

#200 "High-Efficiency Hydrogen Storage via Porous Germanene Nanostructures" *A. Miranda, G. González, B. J. Cid, M. Calvino, J. E. Santana, F. Salazar*

#222 "Energy Management in a Hybrid System Integrating PV Panels, PEM Fuel Cells, and Batteries" *B. Yılmaz, C. O. Colpan*

#235 "Electrooxidation of Methanol and Sodium Borohydride on Nano-Silver Electrode for Alkaline Fuel Cells" *A. Aytaç, F. Ö. Gökmen*

SCIENTIFIC PROGRAM

Poster Session

Poster Session – 3 (Tuesday – May 27, 2025 | 16:00 – 16:30)

#240 "Development of a New Generation Hybrid System for the Electric Vehicle" *A. Aytaç, O. Yılmaz*

#242 "Optimal Design of a New Photovoltaic-Electrolyser-Fuel Cell-Battery Hybrid System" *A. Aytaç, O. Yılmaz*

#246 "Impact of Operational Stoppages on the Stability of Anion Exchange Membrane Electrolysis" *M. Mizanur Rahman, A.H.M Monteverde, M. Santarelli*

#257(1) "Green Synthesis of Fuel Bioadditive Solketal Levulinate by Functional Catalytic Membrane" *N. Y. Yüzer, G. Hasırcı, A. O. Hoşöz, E. E. Çakırca, E. Alptekin, O. İlgen, M. Çanakçı, N. Hilmioğlu*

#257(2) "Development of Environmentally Friendly the Catalytic Membrane as a Catalyst for Synthesis of the Green Fuel Bioadditive Glycerin Carbonate" *G. Hasırcı, N. Y. Yüzer, A. O. Hoşöz, E. E. Çakırca, E. Alptekin, O. İlgen, M. Çanakçı, N. Hilmioğlu*

#258 "Integration and Storage of Hydrogen-Based Fuel Cells for Unmanned Aerial Vehicles" *M. F. Özbek, R. Ak, E. Telci, E. Çelik, H. Settaşı, S. Sezer, V. Alizada, E. C. Duğan, S. A. Angin, R. G. Akay, C. Çelik*

#264 "Sc- and Ti-Functionalized Doped SnC Nanosheets for Hydrogen Storage" *D. Romero, A. R. Montoya-García, L. G. Arellano, M. I. Iturrios, L. A. Pérez, M. Cruz-Irisson*

#269 "Kinetic Modelling on Transient Photocurrent Responses of WO_3 Photoanodes" *E. Ayral, F. Uçar, E. Haznedar, E. Altuntaş, S. Kaya*

#280 "Understanding the Kinetic Mechanism of WO_3 Photoanodes for PEC Applications" *E. İ. Haznedar, F. Uçar, E. Ardalı, E. Altuntaş, S. Kaya*

#295 "Performance Assessment of a Hydrogen Liquefaction Cycle Utilizing Liquefied Natural Gas Regasification and Photovoltaic Panel-Based Power Generation Unit" *M. Taghavi, C. O. Colpan*

#297 "Hydrogen and Volatile Fatty Acid Production from Posidonia Oceanica Seagrass by Dark Fermentation" *D. Kurtdemir, E. Taylan, Ş. Arıcı*

#300 "Thermodynamic Analysis of Claude Cycle for Hydrogen Liquefaction" *Y. Kumlutaş, C. O. Colpan*

#317 "Effect of MoP/g-C_3N_4/Ti_3C_2 Quantum Dots on Photocatalytic Hydrogen Production" *E. S. Şahin, D. Akyüz, E. Demirbaş*

#362 "Assessing Electrolyte Effects in Fuel Cell Systems" *E. Durar, B. Memişoğlu Güzelgün, S. Damarseckin, A. Atız, M. Karakılçık*

#363 "High-Pressure Hydrogen Direct Injection in Optical Combustion Research" *Y. Rousseeuw*

#369 "Scalable Electrode Design Using MPt (M: Cu, Co, Ni) Alloy Nanoparticles for Efficient and Durable Hydrogen Evolution in Seawater Electrolysis" *M.Z. Nezhad, O. Metin*

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#318 "Enhancement of Photocatalytic Hydrogen Production with CoP/g-C_3N_4/Ti_3C_2 Quantum Dots" *B. Camgöz, D. Akyüz, E. Demirbaş*

#320 "Green Synthesis of Fuel Additive Solketal by a Novel Environmentally Friendly Catalytic Membrane" *N. Yenihan Yüzer, N. Hilmioğlu*

#323 "Electrospun Copper-doped Recycled PVDF Membranes for Microbial Fuel Cell Applications" *A. Katırcı, Ö. Ipsalali, S. Kahraman, F. Ugur Nigiz*

#325 "Solar Energy Storage via H_2 Production Using a Thermochemical MnSO4/MnO Water Splitting Cycle" *R.R. Bhosale, A. Arnold, M. Ball, K. Collins, K. Hamilton, N. Heath, J. Hobbs, C. Howell, W. Johnson, C. Kouvarakis, V. Kyslytsya, C. Latham, G. Prater, M. Sanchez, R. Self, A. Sellers, M. Serven*

#335 "Evaluation of the Social Dimensions of Integrating Natural Gas and Hydrogen in Energy Consumption: The Case of Turkiye" *B. Yenihan, K. Çolak, O. Özcan*

#336 "Clean Energy Demand: Evaluating the Use of Hydrogen in Electricity Generation from a Corporate Cost Perspective" *K. Çolak, B. Yenihan, O. Özcan*

#339 "Hydrogen Storage Properties of a Zirconium Metal-organic Framework" *S. Demir, N. Bilgin*

#341 "Enhanced Photoelectrochemical Performance of CeO_2/TiO_2 Heterostructure for Hydrogen and Oxygen Evolution Reactions" *M. Behroozi, E. Doustkhah*

#342 "Integration of Metal–organic Frameworks with Titanium Dioxide for Enhanced Photoelectrochemical Performance in Sustainable Hydrogen Production" *S. Sadighi, E. Doustkhah*

#349 "Enhancing Electric Vehicle Performance with Fuel Cell Integration: Driving Range Optimisation" *V. Tekin, K. Unustu, O. Ozel, C. Colpan, M. Karaoglan*

#351 "Development of Stability and Efficiency of $FAPbI_3$ Perovskite Solar Cells for Hydrogen Evolution" *Ş. Tüzüner, O. Mahmood, Ş. Ela, P. Reiss*

#353 "An Experimental Study of Jet-wall and Jet-jet Interactions of Directly Injected Hydrogen and Methane in a Wave-piston Geometry" *M. Gong, M. Lundgren, J. Eismark, M. Andersson*

#354 "Modernization of a Semi-empirical PEM Fuel Cell Model for Heavy-duty Applications" *B. Dursun, M. Johansson, Ö. Andersson, P. Tunestål*

#357 "Process Simulation of Hydrogen Generation from Biomass Using Aspen Plus" *A. Ataş, N. Javani, Ö. Yücel*

#364 "Effect of Convective Heat Transfer Coefficient on the Metal Hydride Tank During the Absorption Process" *S.C. Bozkır, M.A. Ezan, C.O. Colpan*

#368 "Hydrogen Fuel Cell-Powered UAV Systems: Thermal Management for Extended Flight Missions" *T.M. Tavman, C.Ö. Colpan, M.U. Karaoğlan*

#372 "Development and Verification of 700 Bar Type IV Composite Tank", *A. Gürlek, Ç. Tüfekçi, A.F. Yılmaz, F. Kandeger, F. Keleşoğlu*

PROCEEDINGS

SIMULATION AND ANALYSIS OF METHANE THERMAL DECOMPOSITION IN AN AEROSOL FLOW REACTOR

[1] İzzet KARABAY, [2]İsmail Ekmekci
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ABSTRACT

Methane decomposition is a key process for the production of high-purity hydrogen. Among various reactor configurations, an aerosol flow reactor utilizing concentrated solar energy is considered a highly suitable option for this process. In this study, computational fluid dynamics (CFD) methods were employed to investigate methane decomposition in an aerosol flow reactor, incorporating gas flow dynamics, chemical reaction mechanisms, heat transfer via radiation and convection, and discrete-phase interactions. Developing a generalized model that accurately describes the decomposition process and provides reliable predictive data is of critical importance. CFD modeling offers an effective approach for simulating such complex reactions, enabling faster and more precise predictions. To enhance the accuracy of the model, experimental and theoretical data from previous studies on methane decomposition in an aerosol quartz reactor were utilized. The improved CFD model accounts for methane decomposition rates and simulates the distribution of decomposition products, including hydrogen, carbon, and unreacted methane, under varying methane and carbon feed rates and temperature conditions.

Keywords: Methane decomposition, Flow Reaction, CFD Modelling

1. INTRODUCTION

Methane is a highly favorable gas for hydrogen production due to its high hydrogen density, the highest among all gases. Additionally, pure black carbon can be produced through methane decomposition methods. The methane decomposition process has been applied in industrial plants to produce both black carbon and hydrogen. Numerous studies have focused on understanding and improving the decomposition mechanism, developing stable catalysts, and enhancing reactor efficiency. The aim of this study is to analyze the reaction process, explore the aerosol reactor concept, and conduct an energy analysis. Moreover, the feasibility of solar energy conversion is closely related to the efficiency of thermochemical reactions. Various methods exist for hydrogen production, but methane decomposition is a direct process that does not involve additional reactants in its reaction mechanism. This makes it an important topic in chemical conversion, where heat and mass transfer play crucial roles. Key factors influencing heat transfer include radiation-convection mechanisms and chemical reaction kinetics. There are numerous solar-assisted methods for hydrogen production and solar energy storage as chemical energy, including steam reforming, carbon dioxide reforming, and methane cracking. Among these, the aerosol reactor is a promising candidate for methane decomposition due to its ability to directly absorb solar radiation via black carbon catalysts and gas-phase particles. The aerosol reactor, a quartz tubular reactor, allows direct absorption of solar energy by the fluid and particles, leading to a high heat transfer rate. During methane decomposition, hydrogen gas and solid carbon are produced [1,2]. As a result, the hydrogen obtained has high purity, making purification easier. Therefore, using a quartz reactor is a reasonable choice for methane decomposition to produce hydrogen. Both carbon feeding at the inlet and the carbon produced during the reaction catalyze methane decomposition. Several researchers have contributed significantly to this field. Snoeck conducted experimental and theoretical studies on the kinetic aspects of Ni-based catalysts [3]. Deutschmann investigated partial methane oxidation using finite element methods and developed computational fluid dynamics (CFD) models for both two-dimensional and three-dimensional reaction mechanisms [4]. Matowich conducted experimental research on methane decomposition in an aerosol reactor [5].

2. APPROACH AND METHODOLOGY

This study aims to provide a comprehensive understanding of the methane decomposition mechanism by examining key parameters such as chemical reactions, radiation heat transfer, and two-phase flow dynamics. Additionally, it investigates the effects of these parameters in a two-dimensional reactor model. Previous studies, such as Dahl's [1], have used one-dimensional energy balance equations to offer quick insights for engineers. While these models provide valuable approximations, reactor design engineers require a deeper understanding of how parameter distributions across the reactor cross-section influence system performance. However, ensuring mathematical consistency in simulation data remains a significant challenge. To address this, the finite element method is employed, as it allows for the simultaneous solution of multiple interacting parameters while maintaining numerical accuracy. Hydrogen production via solar-driven methane decomposition in an aerosol reactor is highly advantageous due to its efficient

production process, direct utilization of solar energy, and simplified purification requirements. Methane decomposition in an aerosol reactor involves heterogeneous chemical reactions, where complex interactions between gas-phase chemistry, discrete-phase flow, and radiation modeling play a critical role.

3. METHANE DECOMPOSITION

There are a lot of studies to explain reaction mechanism for the decomposition of hydrocarbons, especially natural gas, propane, ethylene and methane. Steinberg is one of the major proponent researchers about the thermal decomposition mechanism of CH_4 process for H_2 production [1]. Methane (CH_4) is dissociated to carbon (C) black and H_2 according to chemical mechanism below :

$CH_4 \longrightarrow C + 2H_2 \qquad H_{298K} = 74.9$ kJ/mol

$CH_4 \rightarrow C + 2H_2 \qquad \Delta H_{1000K} = 89{,}8$ kJ/gmol

Cantelo was the first scientist who studied theorical and experimental decomposition methane mechanism in 1927. He reported that the starting point of decomposition is 400 C and ending point is 1500 C. It is reported that methane completely is decomposed at 1500 C [10]. In another study, Holmen reported the activation energy as 370 kj/mol between 1770-2270 K [11]. Tessner determined that the activation energy of carbon nuclei formation during methane's thermal decomposition (316.8 kj/mol) is higher than activation energy of carbon crystallites growth [12]. Activation energies are reported 356- 402 kJ/mol at 2000-3000 ^oK temperature ranges for shock tubes reactors. Steinberg is reported that activation energy is 131 kJ/mol between 973- 1173 K and 28-56 atm [1]. There are a lot of studies carried out on the effects of different catalysts on the decomposition of methane. Recent studies were performed by Muradov and Wiemer co-workers. Muradov have studied carbon catalysis for methane decomposition He developed a model that describes the effect of different carbon catalysts and dimensional parameters on the methane decomposition at fluidized bed reactor according to experimental data [13,14]. Dahl and co-workers studied on a solar aerosol reactor and developed a mathematical model that describes methane decomposition [1]. Another study of them is investigating a aerosol reactor that can be used for product applications at pilot dimension [2]. In this paper, we developed a two dimensional numerical model that describes the methane decomposition process in the aerosol quartz reactor that is used by Matowich.

4. REACTOR MODEL

In this study, an aerosol reactor is used with dimension that is used by Matowich' experiments so that results could be checked via another studies results. This reactor is 0,914 m in length and has an inside diameter of 0,076 m as shown in Fig.2. Methane is fed into the top of reactor at five different amounts. Carbon particles is fed with methane so that carbon particles enhance reaction rates. The rates of CH_4 dissociation is determined by measuring the thermal conductivity of the effluent gas after filtering the carbon black particles from the sample[1,2].

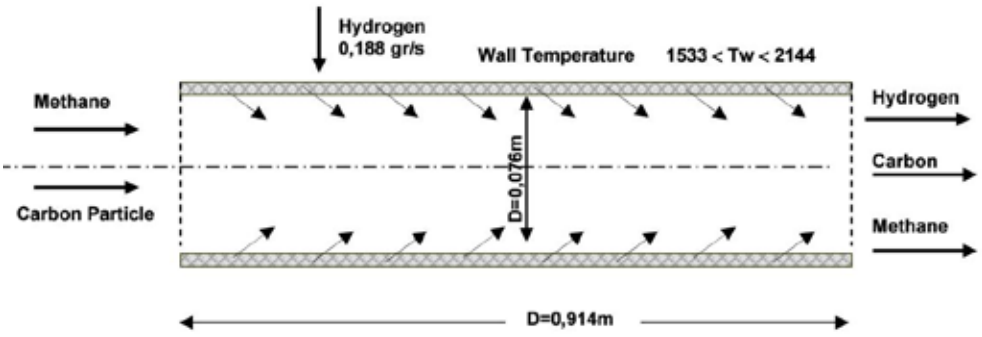


Fig. 1. Schematic representation of aerosol reactor

5. NUMERICAL MODEL

Numerical model is established CFD solutions to supply integrating mechanism elements and displaying conversion distribution in tube as two dimensional. Former studies were only based on experimental research and one-dimensional numerical solutions. We defined proper governing equations such as energy, mass and momentum conservations and species transport equations and also required boundary conditions such as radiation, diffusion and particulate movement BCs to establish numerical model of methane decomposition at the aerosol reactor. Methane decomposition mechanism includes chemical reaction, mass transfer, heat transfer, discrete phase effect,

thermophoresis effect and also lifting effect (Fig.2). On the other hand, defining of chemical conversion mechanism is very important and bringing of accompanying governing equation is one of the difficult subject. Flow in the tube is two phase flow that includes solid carbon particles and continuous methane gas flowing. Solid carbon particles enter to the tube inlet section as a mixture with methane. During the reaction of methane decomposition, carbon particles will be formed along the aerosol tube flow. Discrete phase flow is defined to model of the flow of carbon particles, methane and hydrogen gases during the conversion mechanism along the aerosol tube. Thermophoretic force and lifting effects were also added to our numerical model of aerosol reactor.

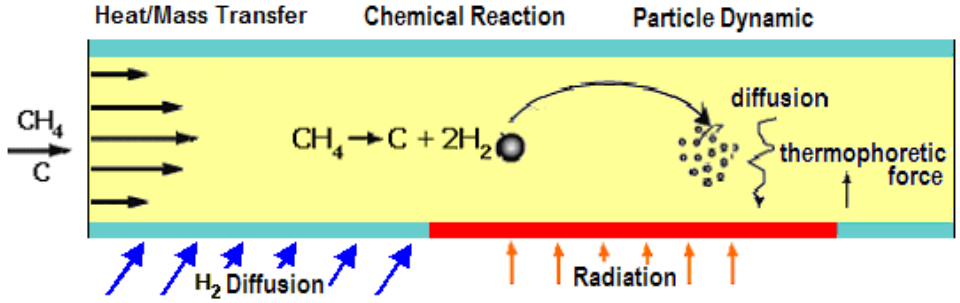


Fig. 2. Schematic representation of numerical model

6. RESULTS AND EVALUATION

Numerical model consists of mass flow, energy conversion, reaction kinetics, radiative heat transfer, discrete phase equations. Model meshing is obtained by using GAMBIT.2.1 for two-dimensional horizontal rectangle shaped reactor. This model is tried to improve the best and the most optimized solution. Using parameters for solving and simulating the reactor are indicated in table-1. These parameters are mostly closest Matovich's experiment and also Dahl and group's simulations. The numerical simulations are based on CFD codes in FLUENT 6.0.12. It solves the conservation equations that is momentum, species, energy, discrete phase and reaction by using a control volume. The methodology used for the 2-D simulations and some of the numerical issues have been explained in elsewhere. FLUENT solves the governing (momentum, species and enthalpy) equations using a control volume based finite difference method. Also the viscosity, specific heat, absorption rate, and the thermal conductivity of the mixture as well as the diffusion coefficient of species are solved simultaneously with governing equations in the mixture depending on the local composition and temperature.

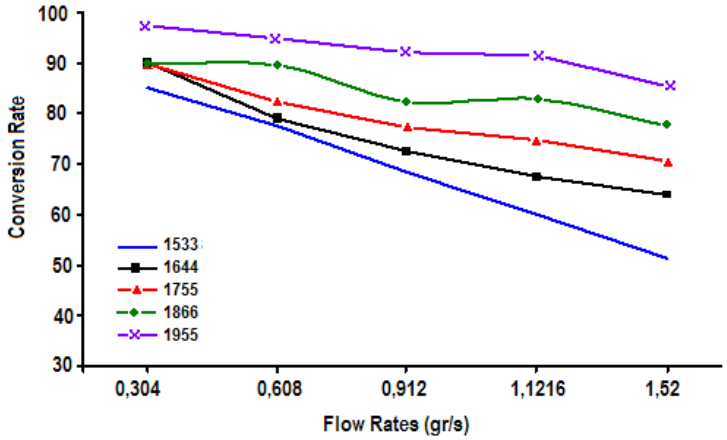


Fig. 3. Molar conversion rates for different mass flow rates and different wall temperatures

Changing of methane conversion rates through reactor related to wall temperatures and flow rates are shown in figure-4. Molar methane conversion rates are indicated for six different temperatures at five different flow rates in the figure. Methane decomposition begins at first length=3-20 cm from beginning of the reactor for all flow rates and 1533 K wall temperature. The latest starting flow rate of decomposition is 1.52 gr/s and the firstest starting flow rate is 0,304 gr/s. This condition can be explained that reaction's activation energy can not be sufficiently supplied for this wall temperatures. So, heat transfer rate is getting insufficient to complete reaction, when flow rates are increasing. Similarly, methane decomposition begins about 0-20 cm for 1644 K wall temperature. Decomposition curves resembles to 1533 K wall temperature's curves. For this reason, it can be said that all decomposition expanding characteristics are similar for these temperatures. Methane decomposition occurs at the beginning away of the reactor

for the other wall temperatures. Conversion curves inclination rises with increasing wall temperatures. As shown at Fig.4, decomposition inclination decrease with remaining flow rates.
Figures-5 indicates methane conversion rates depend on wall temperatures for three flow rates (0,304-0,912-1,52 gr/s) that are periodic difference. According to this figure, while wall temperatures are rising, conversion rate becomes considerably independent from flow rates. Methane decomposition is completing for all flow rates at 2144 K wall temperature. In conclusion, it is obvious that temperature is the most designated factor at methane decomposition mechanism for this reactor. Since carbon particles are a catalyst in the reaction, it is needed to understand the relationship between temperatures of carbon particle and gas phase. Figure-6 is a plot of comparative phase and particle temperatures. Particle temperature is bigger than phase temperature at the first 20 cm of length. After the first length of 20 cm, these temperatures approximate each other and approximately become equal values at the end of the reactor.

7. CONCLUSION

The investigated CFD model for methane decomposition mechanism includes flow-heat-chemical reaction, discrete phase flow and complex mathematical operations in detail. Different parameters' effects on flow reaction can be analysed in different aspects of engineering as well chemical, mechanical, reacting etc. CFD application by using different engineering disciplines is very useful for this type flow reacting problems. It is very useful to investigate new models and also to develop applicable reactor examining. Methane decomposition and kinetic values are another important direction that includes a lot of related intensive and extensive parameters. For example, one of these is activation energy that varies with characteristics of catalysts, particulate geometry, micro chemical structures etc. Therefore, there is not a constant value for kinetic features and chemical reaction kinetics definition is very difficult for this type heterogeneous reaction. As another conclusion from study this modelling enable characteristics of the parameters to understand and define by examining different direction application in aspect of the high way engineering. The fact is that the expanded analysis and solution also can be obtained.

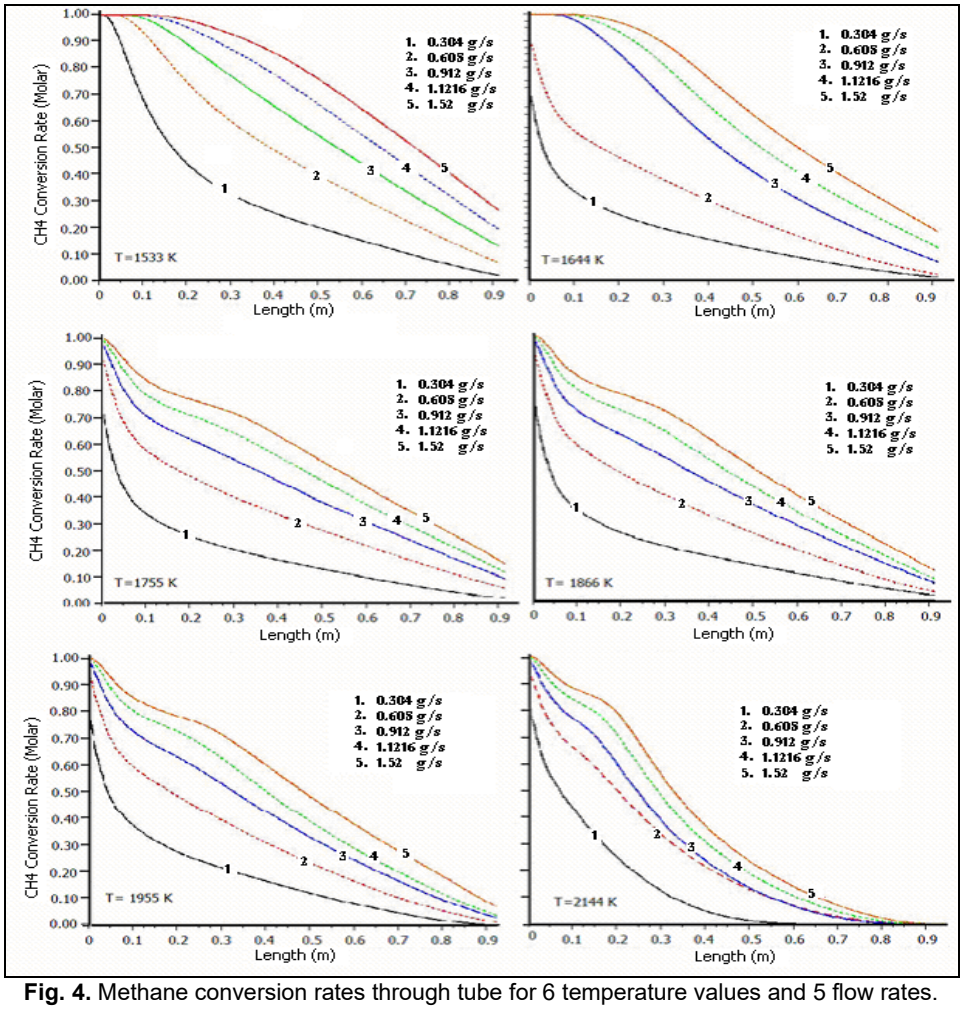


Fig. 4. Methane conversion rates through tube for 6 temperature values and 5 flow rates.

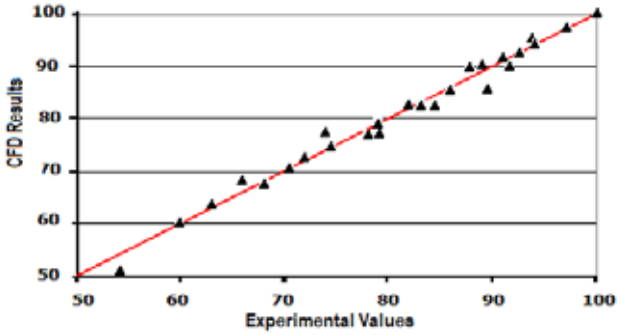


Fig. 5. Methane conversion rates through tube for 6 temperature values and 5 flow rates.

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