Bandar AlOtaibi

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EDUCATION

- **Doctorate of Electrical and Computer Engineering**, McGill University, Canada **2016**
  Specialization: Solar-fuel Devices, Nanomaterial Synthesis, Artificial Photosynthesis
  Dissertation title: "Artificial Photosynthesis for Hydrogen Generation and CO_2 Reduction using Metal-Nitride Nanowires".

- **Master of Applied Science**, Electrical and Computer Engineering, Concordia University, Canada **2011**
  Specialization: Micro/Nano-Electronic systems, Heterostucture-based electronic devices, Wide bandgap semiconductor technologies
  Dissertation title: "Fin and Island Isolation of AlGaN/GaN HFETs and Temperature-dependent Modeling of Drain Current Characteristics of AlGaN/GaN HFETs".

- **Bachelor of Electrical Engineering**, Concordia University, Canada **2008**

RESEARCH EXPERIANCE

- **Research Assistant** (Doctoral research) **Sep 2011-Mar 2016**
  Electrical and Computer Engineering | McGill University | Canada
  - Setup research facilities for photoelectochemical H_2 generation and CO_2 reduction.
  - Led a research projects on Photoelectrochemical H_2 generation and Photochemcial CO_2 reduction.
  - Synthesized (using molecular beam epitaxial growth), characterized (including optical, electrical & structural properties) and evaluated the performance of group-III nitride nanostructured materials for artificial photosynthesis.

- **Research Assistant** **Jan 2009-Jul 2011**
  Electrical and Computer Engineering | Concordia University | Canada
  - Involved in the strain-engineering studies for selective tuning of the pinchoff voltage of AlGaN/GaN heterojunction field-effect transistors (HFETs)

- Involved in the design and micro-fabrication of AlGaN/GaN HFETs.
- Involved in characterization and mathematical modeling of the transport problem through AlGaN/GaN 2DEG channel at elevated temperatures in Micro-Devices and Fabrication Process Laboratory, Concordia University.

- **Research Assistant (undergraduate)** **May 2008-Sep 2008**
  NanoRobotics Laboratory | École Polytechnique | Université de Montréal,
  - Designed circuits for generation of high-power and high-frequency electromagnetic fields for controlling nanoparticles to be used in hyperthermia-based treatments for weakening and elimination of malignant tumors and cancerous cells.

RESEARCH INTEREST

Physics of semiconductors and nanostructured materials; artificial photosynthesis for storable solar energy (including photochemical & photoelectrochemical water splitting and CO_2 reduction); Photoelectrochemistry, Heterogenous photocatalysts, Photovoltiac cells; Electron devices; Growth/synthesis and advanced characterization of novel functional nanomaterials for sustainable energy and environment.

TEACHING AND SUPERVISING EXPERIENCE

- Teaching Assistant
  - Introduction to Semiconductor and Devices (ELEC 321)
    (Helped students with one-to-one interactions on course contents, Explained difficult concepts and theories clearly and concisely, Helped students to understand complicated problems by simplified techniques, Designed the grading scheme of the assignments)
  - Nanomaterials for solar-to-fuel applications (planned to be taught in 2017)
    (Involved in the design of the course materials, teaching aids and slides for my doctoral research advisor)

- Supervision and Mentorship

  ➢ **Graduate Thesis Mentorship**

  - Mentored post-docs and Ph.D. students

  ➢ **Undergraduate Thesis Supervisions**

  - Sole thesis/projects supervision and mentorship of four BSc. Students.

AWARDS/SCHOLARSHIPS

- King Abdullah Foreign Scholarship for three successive times:
  - 2011-2016
  - 2009-2011
  - 2003-2009

- King Abdullah Excellence Reward (5 times)

PUBLICATIONS

- Patent

  - Z Mi (34%), S Fan (33%), and **B AlOtaibi** (33%), "Photocathodes and dual photoelectrodes for nanowire photonic devices," US20160273115 A1, 2016.

  - **B AlOtaibi** (100%), "Highly Efficient Solar Energy Conversion using Stacked-band Nanowire," *under preparation for submission to Saudi Patent Office*.

- Book Chapter

  M.G. Kibria, **B. AlOtaibi**, Zetian Mi, "Metal-Nitride Nanostuctures: Emerging Catalysts for Artificial Photosynthesis" in "Nanomaterials for Energy Conversion and Storage", Imperial College Press/World Scientific (published in Dec. 2017).

- Journals (peer-reviewed)

  - **B AlOtaibi**, X Kong, S Vanka, S Woo, A Pofelski, F Oudjedi, S Fan, MG Kibria, G Botton, W Ji, H Guo, and Z Mi, "Photochemical Carbon Dioxide Reduction on Mg-doped Ga(In)N Nanowire Arrays under Visible Light Irradiation", *ACS Energy Letters* 2016 (1), 246-252.

  - **B AlOtaibi**, S Fan, S Vanka, MG Kibria, Z Mi, "A Metal-Nitride Nanowire Dual-Photoelectrode Device for Unassisted Solar-to-Hydrogen Conversion under Parallel Illumination", *Nano Letters* 2015 (10), 6821-6828. (IF=13.592)

  - **B AlOtaibi**, S Fan, D Wang, J Ye, Z Mi "Wafer-Level Artificial Photosynthesis for CO_2 reduction into CH_4 and CO using GaN Nanowires", *ACS Catalysis* 2015 (9), 5342-5348. (IF=9.312)

  - **B AlOtaibi**, HPT Nguyen, S Zhao, MG Kibria, S Fan, Z Mi, "Highly Stable Photoelectrochemical Water Splitting and Hydrogen Generation using a

Double-Band InGaN/GaN Core/Shell Nanowire Photoanode", *Nano Letters* 2013 (9), 4356-4361. (IF=13.592)

- **B AlOtaibi**, M Harati, S Fan, S Zhao, H P T Nguyen, M G Kibria and Z Mi, "High Efficiency Photoelectrochemical Water Splitting and Hydrogen Generation Using GaN Nanowire Photoelectrode", *Nanotechnology* 2013 (24), 175401. (IF=3.821)

- **B AlOtaibi**, P Valizadeh, "Investigation of the High-Temperature Operation of AlGaN/GaN HFETs via Studying the Impact of Temperature Dependency of Drift Transport Characteristics", *IEEE Transactions on Device and Materials Reliability*, 2012 (3), 547-553. (IF=1.89)

- L Jin, **B AlOtaibi**, D Benetti, S Li, H Zhao, Z Mi, A Vomiero and F Rosei, "Near-infrared Colloidal Quantum Dots for Efficient and Durable Photoelectrochemical Solar-Driven Hydrogen Production", *Advanced Science* 2016, (3), 1500345. (IF=6)

- Y Wang, **B AlOtaibi**, FA Chowdhury, S Fan, MG Kibria, L Li, CJ Li, Z Mi, "Photoelectrochemical Reduction of Carbon Dioxide using Ge Doped GaN Nanowire Photoanodes", *Applied Physics Letters- Materials* 2015 (11), 116106. (IF=2.789)

- S Li, **B AlOtaibi**, W Huang, Z Mi, N Serpone, R Nechache, F Rosei "Epitaxial Bi_2FeCrO_6 Multiferroic Thin Film as a New Visible Light Absorbing Photocathode Material", *Small* 2015 (32), 4018-4026. (IF=8.368)

- S Fan, **B AlOtaibi**, SY Woo, Y Wang, GA Botton, Z Mi, "High Efficiency Solar-to-Hydrogen Conversion on a Monolithically Integrated InGaN/GaN/Si Adaptive Tunnel Junction Photocathode", *Nano Letters* 2015 (4), 2721-2726. (IF=13.592)

- P Valizadeh, **B AlOtaibi**, "Fin-and Island-Isolated AlGaN/GaN HFETs", *IEEE Transactions on Electron Devices* 2011 (5), 1404-1407. (IF=2.472)

- A Adhikari, L Jin, F Navarro Pardo, D Benetti, **B AlOtaibi**, S Vanka, H Zhao, Z Mi, A Vomiero and F Rosei, "High Efficiency, Pt-free Photoelectrochemical Cells for Solar Hydrogen Generation based on "Giant" Quantum Dots", *Nano Energy* 2016, 27, 265-274. (IF=12.272)

- MG Kibria, FA Chowdhury, S Zhao, **B AlOtaibi**, ML Trudeau, H Guo, Z Mi, "Visible Light-Driven Efficient Overall Water Splitting using *p*-Type Metal-Nitride Nanowire Arrays", *Nature Communication* 2015 6, 6797. (IF=11.47)

- Z Xu, MG Kibria, **B AlOtaibi**, P Duchesne, L Besteiro, Y Gao, Q Zhang, Z Mi, P Zhang, A Govorov, L Mai, M Chaker, D Ma, "Towards enhancing

photocatalytic hydrogen generation: Which is more important, alloy synergistic effect or plasmonic effect?", Applied Catalysis B: Environmental, 221, 77-85. (IF= 9.44)

- Y Wang, S Fan, **B AlOtaibi**, Y Wang, and Z Mi, "A Monolithically Integrated Nanowire/Si Solar Cell Photocathode for Selective Carbon Dioxide Reduction to Methane", *Chemistry-A European Journal* 2016 *01642*. (IF= 5.771)

- H Zhao, J Lei, **B AlOtaibi**, Z Fan, A Govorov, Z Mi, F Rosei, A Vomiero, "Green Synthesis of Near Infrared Core/shell Quantum Dots for Photocatalytic Hydrogen Production", *Nanotechnology*, 27 (49), 2016. (IF= 3.821)

- Conferences presentations/proceedings (Peer-reviewed Abstract/Extended abstract)

  - **B AlOtaibi**, "III-Nitride Nanowires for Photoelectrochemical Solar Fuel Production," Invited Talk, King Saud University, 21-11-2016.

  - **B AlOtaibi**, "Accelerating nature: Artificial photosynthesis using III-nitride nanowires," Invited Talk on KAUST Research Conference 2016: Emerging Concepts and Materials in Solar Energy Conversion, 1-11-2016.

  - **B AlOtaibi**, "Solar Energy: Since the Formation of Earth to Nanotechnology Era," Invited talk, Shaqra University, 24-4-2016.

  - **B AlOtaibi**, S Fan, HPT Nguyen, S Zhao, MG Kibria, Z Mi, "Photoelectrochemical Water Splitting and Hydrogen Generation using InGaN/GaN nanowire arrays", *Photonics Society Summer Topical Meeting Series* IEEE, 206-207, 2014.

  - **B AlOtaibi**, S Fan, Z Mi, "Photoelectrochemical Water Splitting on GaN and InGaN/GaN Core/Shell Nanowires", International Workshop on Nitride Semiconductors (IWN), Poland, August, 2014.

  - **B AlOtaibi**, S Fan, S Zhao, HPT Nguyen, and Z Mi, "Stable Photoelectrochemical Water Reduction using *p*-GaN Nanowire Photocathode Decorated by Platinum Nanoparticles", Photonics North, Ottawa, Canada, June, 2013.

  - **B AlOtaibi**, M Harati, MG Kibria, S Fan, HPT Nguyen, S Zhao, and Z Mi, "Photoelectrochemical Hydrogen Production using GaN Nanowire Arrays", Photonics North, Montreal, Quebec, Canada, June 6-8, 2012.

- **B AlOtaibi**, M Harati, MG Kibria, S. Fan, S Zhao, HPT Nguyen, and Z Mi, "Photoelctrochemical hydrogen generation on InGaN nanowire arrays", MRS Fall Meeting, Boston, USA, Nov 25-30, 2012.

- S Vanka, **B AlOtaibi** and Z Mi, "High-Rate CO_2 Photoreduction to CH_3OH on Metal-Nitride Nanowires", HTCMC-9 & GFMAT, 2016.

- Z Mi, **B AlOtaibi**, S Fan, (Invited) "High Efficiency Solar-to-Hydrogen Conversion on InGaN Nanowire Arrays", ECS Meeting Abstracts (23) 1447-1447, 2015.

- Z Mi, **B AlOtaibi**, S Fan, "Solar-to-Hydrogen Production on Multi-Band Photoelectrodes: Surpassing the Current Matching Requirements of Conventional Tandem Devices", ECS Meeting Abstract, 2015, MA2015-02 1688.

- M Harati, **B AlOtaibi**, MG Kibria, S Fan, S Zhao, HPT Nguyen, and Z Mi, "*n*-InGaN Nanowire Arrays for Photoelctrochemical Hydrogen Generation", Material Research Society Fall 2012, Hynes Convention Center, Boston, MA, November 25 - 30, 2012.

- Z Mi, MG Kibria, **B AlOtaibi**, F Chowdhury, S Fan, S Zhao, and HPT Nguyen, "High Efficiency Water Splitting using InGaN Nanowire Photocatalysts and Photoelectrodes", The 15th IUMRS-International Conference in Asia (IUMRS-ICA), Fukuoka, Japan, August 24-30, 2014.

- Z Mi, MG Kibria, **B AlOtaibi**, F Chowdhury, S Fan, "High Efficiency Water Splitting on InGaN Nanowire Arrays under Ultraviolet and Visible Light Irradiation", International Conference on New Advances in Materials Research for Solar Fuels Production, Montréal, Canada, June 24-26, 2014.

RESEARCH ACHIEVEMENTS

- Proposed a novel photoelectrode that can break the Shockley-Queisser limit
- Demonstrated a 'proof-of-concept' of high efficient H_2 generation of dual-photoelectrode using parallel illumination.
- Identified the key bottleneck in achieving high efficiency H_2 generation on nanomaterials.
- Demonstrated the highest reported reduction rate of CO_2 into methanol under visible illumination
- Demonstrated for the first time the photochemical CO_2 reduction on GaN nanowires
- Contributed to the demonstration of the most efficient photocatalysts for water splitting under visible light

ACADEMIC AND NON-ACADEMIC SERVICES

- Reviewed many manuscripts for honorable scientific journals including: Nanotechnology, Journal of Physics: Applied Physics, etc.
- Invited guest editor in a special issue in the Journal of Nanomaterials.

ACADEMIC HISTORY

The academic tree and academic relations to the progenitors of the so-called scientific revolution and of the modern physics.