CURRICULUM VITAE
HUSSEIN O. BADR

EDUCATION

Ph.D. **Drexel University,** Philadelphia, U.S. Fall 2018 – June 2023
Pursuing degree in Nanostructured Materials Science and Engineering (GPA 3.97),
Department of Materials Science and Engineering

BSc & M.Sc. **Cairo University,** Cairo, Egypt June 2016 & 2018
Degree in Materials for Energy Applications,
Thesis: Polymer nanocomposites for thermoelectric applications,
Department of Metallurgical Engineering and Materials Science

PROFESSIONAL EXPERIENCE

Stanford University, Stanford, CA, U.S. March 2024 – Present
- Postdoctoral Scholar, Chemical Engineering Department

- Designing and developing energy systems following electrolysis and photoelectrolysis processes along with using my materials engineering background to develop catalyst and membrane materials and devices that can conduct chemical transformation of interest in areas of energy and sustainability.

Drexel University, Philadelphia, PA, U.S. July 2023 – March 2024
- Postdoctoral Researcher, Department of Materials Science and Engineering

- **Developed a new solution processing-based protocol to prepare *High Entropy Oxides* under ambient conditions**. Extensive characterization to resolve structure, composition, and morphology is currently in progress.

Drexel University, Philadelphia, U.S. August 2018 – June 2023
- Research Assistant, Department of Materials Science and Engineering

- **Discovered a novel protocol to prepare metal oxides nanostructures** (various compositions, morphologies, and structures) on the kilogram scale, at near ambient conditions, and under atmospheric pressure.
- **Worked closely with 100+ collaborators** on several applications of our discovery including electrocatalytic water splitting, photocatalytic hydrogen production, water purification, solar cells, Li-ion and Li-S batteries, urea dialysis, among many more.
- **Filed 7 patent applications and published 30 research articles**.
- Participated in 15+ international conferences including MRS, ACS, MS&T, TMS, and many more and built a number of collaborations.
- Have been mentoring and training undergraduate and graduate students, visiting researchers, and collaborators in a holistic, encouraging, and supportive way to build up the next generation of researchers.

- Entrepreneurship, Doing commercialization in partnership with Drexel Office of Innovation and NSF program of commercialization (Innovation Corps, I-Corp).

- Completed both Regional and National I-Corps
- Participated in the following industrial conferences:
World Hydrogen 2023 Summit in Rotterdam, The Netherlands
Hydrogen & Fuel Cells Seminar 2023 in Los Angeles, CA

Transit Agency Infrastructure Workgroup Meeting for Zero-Emission Buses
- Recitation Instructor, Department of Materials Science and Engineering.

Cairo University, Cairo, Egypt June 2016 – August 2018
Teaching and Research Assistant, Department of Metallurgical Engineering.
American University in Cairo, Cairo, Egypt June 2016 – August 2018
Research Assistant, Energy Materials Lab, Physics Department.
British University in Egypt, Cairo, Egypt June 2016 – August 2018
Research Assistant, Department of Mechanical Engineering.

AWARDS AND RECOGNITIONS

- Nominated to Research Award of Excellence, Drexel, 2023
- Featured in the Graduate College testimonial for Drexel Emerging Scholars Conference. https://drexel.edu/graduatecollege/professional-development/emerging-graduate-scholars-conference/testimonials/
- Best Poster Award nomination in MRS Spring 2023/2023.
- Awarded the 2022-2023 Teck-Kah Lim Graduate Student Domestic Travel Subsidy Award Application.
- Featured in Drexel's Doctoral Newsletter in the October 2022 issue. (https://www.linkedin.com/feed/update/urn:li:activity:6982765034011512832/)
- Featured for Matter author spotlight for the July 2022 issue. (https://twitter.com/Matter_CP/status/1571862053760950273)
- Our article about "TiO_2-based one-dimensional nanofilaments" featured in the news: Mat Today press (Bottom-up approach yields 2D nanomaterials by the kilo - ScienceDirect) AZOnano news (https://www.azonano.com/news.aspx?newsID=38424)
- Nominated to Research Award of Excellence, Drexel, 2022
- College of Engineering Carleone Award for outstanding Research, Drexel, 2022.
- Award of Excellence in Engineering, Egyptian Engineering Association, 2019.
- Second place, Energy Competition, Egyptian Engineering Day 2016.
- Mohamed Abd Alkareem Award, College of Engineering, Cairo University, 2017.
- Award of Excellence in Engineering, Egyptian Engineering Association, 2017
- Ranked the first in 2016 class, Dept. of Metallurgical Eng., Cairo University.

ISSUED PATENTS

1) Michel W. Barsoum and **Hussein O. Badr**, "Bottom-up, scalable synthesis of oxide-based sub-nano and nanofilaments and nanofilament-based two-dimensional flakes and mesoporous powders", US Patent App. 18/448,593

PENDING PATENTS

2) Rahul N. Pai, Vibha Kalra, Michel W. Barsoum and **Hussein O. Badr**, "Metal carbo-oxides (Titanium carbo-oxide and others) as an active electrode in Lithium-sulfur battery" Filed in April 2021.
3) Michel W. Barsoum, **Hussein O. Badr** and Joshua Snyder "Nanomaterial-based adsorption processing and catalysis" Filed in February 2022.
4) Michel W. Barsoum and **Hussein O. Badr**, "Nanomaterial-based processing of dyes and organic compounds" Filed in February 2022
5) Michel W. Barsoum, **Hussein O. Badr** and Tarek A. ElMeligy "Method to Fabricate Nanoparticles" Filed in March 2021.
6) Michel W. Barsoum, **Hussein O. Badr** and Kiana Montazeri "One-dimensional titanium dioxide nanostructures synthesized using alkaline solutions including sodium/potassium hydroxide at near ambient conditions" Filed in June 2022.

7) Michel W. Barsoum and **Hussein O. Badr**, "Bottom-Up, Scalable Synthesis of Oxide-Based Sub-Nano And Nanofilaments And Nanofilament-Based Two-Dimensional Flakes And Mesoporous Powders" Filed in August 2022.

PUBLICATIONS

2024

1) Hussein O. Badr and Michel W. Barsoum, "Hydroxide-derived Nanostructures: Scalable Synthesis, Characterization, Properties and Potential Applications" Adv. Mater. (2024), 2402012.
https://doi.org/10.1002/adma.202402012
2) Francisco Lagunas, David Bugallo, Fatemeh Karimi, Yingjie Yang, Hussein O. Badr, Jacob H Cope, Emilio Ferral, Michel W Barsoum, Yong-Jie Hu, Robert F Klie, "Ion-Exchange Effects in One-Dimensional Lepidocrocite TiO_2: A Cryogenic Scanning Transmission Electron Microscopy and Density Functional Theory Study" Chem Matter (2024), 36, 2743-2755.
https://doi.org/10.1021/acs.chemmater.3c02773

2023

3) **Hussein O. Badr**, Jacob Cope, Takayuki Kono, Takeshi Torito, Francisco Lagunas, Emmanuel Castiel, Robert F. Klie, and Michel W. Barsoum, Titanium Oxide-based 1D Nanofilaments, 2D Sheets, and Mesoporous Particles - Synthesis, Characterization and Ion Intercalation (2023) Matter 6, 3538-3554.
https://doi.org/10.1016/j.matt.2023.07.022
4) **Hussein O. Badr**,^ Francisco Lagunas,^ Daniel E. Autrey, Jacob Cope, Takayuki Kono, Takeshi Torita, Robert F. Klie, Yong-Jie Hu, and Michel W. Barsoum, "On the Structure of One-Dimensional TiO_2 Lepidocrocite" (2023) Matter 6, 128-141.
https://doi.org/10.1016/j.matt.2022.10.015
5) Olivia Wilson, Michael Carey, Jacob Cope, **Hussein O. Badr**, Jacob Nantz, Tarek Elmelegy, Michel Barsoum, Andrew Magenau, Repairable and Reinforced Composites of One-Dimensional Titania Lepidocrocite Mesoparticles with Thiol-Yne Networks via Alkylborane-Initiated, In Situ, "Click" Polymerization, (2023) Chem. Mater.
https://doi.org/10.1016/j.xcrp.2023.101434
6) Erika Colin-Ulloa, Julia L. Martin, Ryan J. Hanna, Michelle H. Frasch, Rebecca R. Ramthun, **Hussein O. Badr**, Michel W. Barsoum, Ronald L. Grimm, and Lyubov V. Titova, "Electronic Structure of 1D Sub-nanometer Lepidocrocite-Like Structures as Revealed by Transient and Steady-State Optical Absorption and Photoelectron Spectroscopy", (2023) J. Phys. Chem. C., 127, 15, 7275-7283.
https://doi.org/10.1021/acs.jpcc.2c06719
7) Gregory R. Schwenk, **Hussein O. Badr**, Adam D. Walters, Takayuki Kono, Mary Qin Hassig, Kiana Montazeri, M. W. Barsoum, "Hydroxide-Derived Mild Synthesis of Titania: 1D Lepidocrocite Nanotubes and Nanowires" (2023) Ceramics Int. 49, 24, 40001-40010
https://doi.org/10.1016/j.ceramint.2023.09.328
8) Lin Wang[#], **Hussein O. Badr**[#], Yang Yang[#], Jacob Cope, Enzhao Ma, Jiafeng Ouyang, Liyong Yuan, Zijie Li, Zhirong Liu, Michel W. Barsoum, Weiqun Shi, "Unique Hierarchical Structures of One Dimensional Lepidocrocite Titanate with Cation-Exchangeable Sites for Extraordinary Selective Actinide Capture for Water Purification", (2023) J. Chem. Eng. 474, 145635.
https://doi.org/10.1016/j.cej.2023.145635
9) Kaustubh Sudhakar, Takayuki Kono, Tarek El-Melegy, **Hussein O. Badr**, Prajwal L. Mulukatte, Kiana Montazeri, Steven May, and Michel W. Barsoum, "One pot, scalable

synthesis of hydroxide derived ferrite magnetic nanoparticles" (2023) J. Magn. Magn. Mater. 582, 170986.
https://doi.org/10.1016/j.jmmm.2023.170986

10) Neal Cardoza; **Hussein O. Badr**; Rhyz Pereira; Michel Barsoum; Vibha Kalra, "One-Dimensional, Titania Lepidocrocite-based, Nanofilaments and Their Polysulfide Anchoring Capabilities in Lithium Sulfur Batteries" (2023) ACS Appl. Mater. Interfaces 15, 44, 50973.
https://doi.org/10.1021/acsami.3c03743
11) Mary Qin Hassig, Takayuki Kono, Michael Carey, Kaustubh Sudhakar, Gregory R. Schwenk, **Hussein O. Badr**, Michel W. Barsoum, "Reacting Mn_3O_4 powders with quaternary ammonium hydroxides to form two-dimensional birnessite flakes" Ceram. Int. 49, 21, 33537-33545.
https://doi.org/10.1016/j.ceramint.2023.07.256
12) **Hussein O. Badr** and Michel W. Barsoum, On Ripplocations and the Deformation of Graphite, **Carbon** 201, (2023) 599-615.
https://doi.org/10.1016/j.carbon.2022.09.042
13) Kaustubh Sudhakar, Avishek Karmakar, **Hussein O. Badr**, Kiana Montazeri, Craig Johnson, Mary Q. Hassig, Michael Carey, Tarek El-Melegy, Stefan Masiuk, Qian Qian, C. Li and Michel W. Barsoum‡*, "One-dimensional, titania-based lepidocrocite nanofilaments and their self-assembly", (2023) Matter 6, 9, 2834-2852.
https://doi.org/10.1016/j.matt.2023.06.006

2022

14) **Hussein O. Badr**, Tarek El-Melegy, Michael Carey, Varun Natu, Mary Q. Hassig, Craig Johnson, Qian Qian, Christopher Y. Li, Kateryna Kushnir, Erika Colin-Ulloa, Lyubov V. Titova, Julia L. Martin, Ronald L L. Grimm, Rahul Pai, Vibha Kalra, Avishek Karmakar, Anthony Ruffino, Stefan Masiuk, Kun Liang, Michael Naguib, Olivia Wilson, Andrew Magenau, Kiana Montazeri, Yucheng Zhu, Hao Cheng, Takeshi Torita, Masashi Koyanagi, Akimaro Yanagimachi, Thierry Ouisse, Maxime Barbier, Fabrice Wilhelm, Andrei Rogalev, Jonas Björk, Per O.Å. Persson, Johanna Rosen, Yong-Jie Hu, Michel W. Barsoum "Bottom-up, scalable synthesis of two-dimensional titanium carbo-oxide-based conductive flakes", (2022) **Mat. Today** 54, 8-17.
https://doi.org/10.1016/j.mattod.2021.10.033
15) **Hussein O. Badr**, Kiana Montazeri, Tarek El-Melegy, Varun Natu, Michael Carey, Ramchandra Gawas, Phu Phan, Qian Qian, Christopher Y Li, Ulf Wiedwald, Michael Farle, Erika Colin-Ulloa, Lyubov V Titova, Marc Currie, Thierry Ouisse, Maxime Barbier, Andrei Rogalev, Fabrice Wilhelm, Marcus Hans, Jochen M Schneider, Christopher Tandoc, Young-Jie Hu, Joshua Snyder, Michel W Barsoum, "Scalable, Inexpensive, Facile Synthesis of Two-dimensional Manganese Oxide Birnessite", **Matter** 5, 7, (2022) 2365-2381.
https://doi.org/10.1016/j.matt.2022.05.038
16) **Hussein O. Badr**, Varun Natu, Ștefan Neațu, Florentina Neațu, Andrei Kuncser, Arpad M. Rostas, Matthew Racey, Michel W. Barsoum, and Mihaela Florea, "Ultra-stable, 1D TiO_2 Lepidocrocite for Photocatalytic Hydrogen Production in Water-Methanol Mixture", (2022) Matter.
https://doi.org/10.1016/j.matt.2023.05.026
17) Kiana Montazeri; **Hussein O. Badr**; Ken Ngo; Kaustubh Sudhakar; Tarek Elmelegy; Joshua Uzarski; Varun Natu; Michel Barsoum, "Delamination of MXene Flakes Using Simple Inorganic Bases" (2022), J. Phys. Chem. C., 127, 10391-10397.
https://doi.org/10.1021/acs.jpcc.3c02318
18) Wei Zheng, Joseph Halim, Li Yang, **Hussein O. Badr**, Zheng Ming Sun, Per O.Å. Persson, Johanna Rosen, Michel W. Barsoum, "MXene//MnO_2 asymmetric supercapacitors with high voltages and high energy densities", (2022) **Batter. Supercaps,** 5, e20220015.
https://doi.org/10.1002/batt.202200151

19) Ayat Ellamey, **Hussein Badr**, and Iman El-Mahallawi, "Structure and Thermoelectric Behavior of Polyaniline-based/ CNT-composite", **Curr. Appl. Phys**, 2022. https://doi.org/10.1016/j.cap.2021.11.012
20) Varun Natu, Rahul Pai, Olivia Wilson, Edward Gadasu, **Hussein Badr**, Avishek Karmakar, Andrew J. D. Magenau, Vibha Kalra, and Michel W. Barsoum, "Effect of Base/Nucleophile Treatment on Interlayer Ion Intercalation, Surface Terminations, and Osmotic Swelling of Ti_3C_2Tz MXene Multilayers Chem. Mater. 2022, 34, 2, 678–693 https://doi.org/10.1021/acs.chemmater.1c03390

2017-2021

21) **Hussein O. Badr**, X. Zhao, S. Koumlis, G. J. Tucker, L. Lamberson and M. W. Barsoum, Confined buckling in thin sheets and its correlation to ripplocations; a deformation mechanism in layered solids, (2021) **Phys. Rev. Mater.** 5, 093603. https://doi.org/10.1103/PhysRevMaterials.5.093603
22) Luke A Hanner, **Hussein O. Badr**, Martin Dahlqvist, Sankalp Kota, David Raczkowski, Johanna Rosen, Michel W Barsoum, "Synthesis, characterization and first principle modelling of the MAB phase solid solutions: $(Mn_{1-x}Cr_x)_2AlB_2$ and $(Mn_{1-x}Cr_x)_3AlB_4$", (2021) **Mater. Res. Lett.**, 9. https://doi.org/10.1080/21663831.2020.1845834
23) **Hussein O. Badr**, Aurélie Champagne, Thierry Ouisse, Jean-Christophe Charlier, Michel W Barsoum, "Elastic properties and hardness values of V_2AlC and Cr_2AlC single crystals" (2020) **Phys. Rev. Mater.** 4, 083605. https://doi.org/10.1103/PhysRevMaterials.4.083605
24) Ayat Ellamey, Ahmed Sedki, Amr Hasanin, **Hussein Badr**, Iman El-Mahallawi, "Design and Manufacturing of Polyaniline-based Thermoelectric Generators", IEEE, 214-216, 2019. https://doi.org/10.1109/ACCS-PEIT48329.2019.9062855
25) **Hussein Badr**, Iman S El-Mahallawi, Fawzi A Elrefaie, Nageh K Allam, "Low-temperature thermoelectric performance of novel polyaniline/iron oxide composites with superior Seebeck coefficient", (2019) Appl. A, 125. https://doi.org/10.1007/s00339-019-2822-3
26) **H. O. Badr**, M Sorour, SF Saber, IS El-Mahallawi, FA Elrefaie "DOC-Stabilized PVAc/MWCNTs Composites for Higher Thermoelectric Performance", Energy Technology, 283-291, TMS, 2019. https://doi.org/10.1007/978-3-030-06209-5_29
27) Iman El-Mahallawi, **Hussein Badr**, Remon Ashraf and Saeed S.I.AlMishal, "Sustainable Materials for Energy Conversion" Reference Module in Materials Science and Materials Engineering, 2018.
28) IS El-Mahallawi, AA Abdel-Rehim, N Khattab, NH Rafat, **H. O. Badr** "Effect of Nano-graphite Dispersion on the Thermal Solar Selective Absorbance of Polymeric-based Coating Material", Advanced Materials for Energy Conversion and Storage, TMS, 2017. https://doi.org/10.1007/978-3-319-72362-4_49
29) **Hussein Badr**, Mostafa Amr Youssef, Hebatullah Sayed Abd Elsalam, Mirna Abd Elrahman Mohamed, Mohamed Gamal El-kholy, Iman S. El-Mahallawi, Ahmed A Abdel-Rehim "Thermoelectric behavior of polyvinyl acetate / CNT composites", Alloys and Compounds for Thermoelectric and Solar Cell Applications V symposium, TMS, 2016. https://doi.org/10.1007/978-3-319-51493-2_27

SUBMITTED FOR PUBLICATIONS

30) Nicholas Carpentieri, **Hussein O. Badr**, Kiana Montazeri, Mary Qin Hassig, Gregory Schwenk, Ramchandra Gawas, Michel Barsoum, Joshua Snyder, "Ni/Fe Doped One Dimensional Lepidocrocite Titania and Oxygen Evolution Reaction" (2024).
31) **Hussein O. Badr**[#], Mary-Qin Hassig[#], Yucheng Zhu, Gregory Schwenk, Hao Chen, Michel W. Barsoum, "On the colloidal stability, sedimentation and aggregation of crystalline two-dimensional birnessite flakes" (2023) Submitted for publication.
32) **Hussein O. Badr**, Nina J. Lane, Babak Anasori, Riyanka Pai, Michel W. Barsoum, "Spherical Nanoindentation and Kinking Nonlinear Elasticity in Graphite" (2023), Submitted for publication.