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Formal Education and Appointments

School of Chemical Engineering, University of New South Wales
Senior Lecturer (2020-current)

School of Chemical Engineering, University of New South Wales
Lecturer (2018-2020)

US Air Force Research Laboratory
Materials Research Engineer (2016-2018)

National Institute of Standards and Technology
Professional Research Experience Program Postdoctoral Associate (2014-2016)
Advisor: Timothy P. Quinn, Ph.D.

Air Force Research Laboratory/University of Miami
National Research Council Postdoctoral Associate (2012-2014)
Advisors: Rajesh R. Naik, Ph.D.

The University of Cincinnati, Cincinnati, OH
Ph.D. in Materials Science and Engineering (2007- 2012)
Dissertation Title: "Electrospun fibers for Energy, Electrical and Environmental Applications"
Advisor: Andrew J. Steckl, Ph.D. and Donglu Shi, Ph.D.

Central Michigan University, Mt. Pleasant, MI
B.S. in Chemistry, B.S. in Physics, Mathematics minor (2002-2007)
Undergraduate Research Project (Physics): "X-Ray Diffraction of Nano-Scale Materials"
Advisor: Valeri Petkov, Ph.D.
Undergraduate Research Project (Chemistry): "Solvent Effect on Hydrodynamic Radii of PPI Dendrimers"
Advisor: Minghui Chai, Ph.D.

Research Interests

- Structure/function relationship analysis of functional nanomaterials
- Synchrotron X-ray characterization techniques/modeling
- Nanostructured materials for clean energy and sustainability
- Bio-enabled nanotechnology for emergent materials

Publications

Peer-Reviewed Papers (*denotes corresponding author), current H-index of 28 (Google Scholar)

1. H. Fu, J. Liu, N. M. Bedford, Y. Wang, J. Wright, P. F. Liu, Ch. F. Wen, L. Wang, H. Yin, D. Qi, P. Liu,* H. G. Yang, H. Zhao* "Operando Converting BiOCl into Bi₂O₂(CO₃)_xCl_y for Efficient Electrocatalytic Reduction of Carbon Dioxide to Formate", *Nano-Micro Lett.* **2022**, 14, 121 DOI: 10.1007/s40820-022-00862-0

2. L. Zong, F. Lu, W. Zhang, K. Fan, X. Chen, B. Johannessen, D. Qi, N. M. Bedford, M. Warren, C. U. Segre, P. Liu,* L. Wang,* H. Zhao* "Atomically-dispersed Mn-(N-C₂)₂(O-C₂)₂ sites on carbon for efficient oxygen reduction reaction", *Ener. Storage Mater.* **2022**, *49*, 209 DOI: 10.1016/j.ensm.2022.04.016
3. Z. Ma, C. Tsounis, C. Y. Toe, P. V. Kumar, B. Subhash, S. Xi, H. Y. Yang, S. Zhou, Z. Lin, K.-H. Wu, R. J. Wong, L. Thomsen, N. M. Bedford, X. Lu, Y. H. Ng, Z. Han,* R. Amal* "Reconstructing Cu Nanoparticle Supported on Vertical Graphene Surfaces via Electrochemical Treatment to Tune the Selectivity of CO₂ Reduction toward Valuable Products", *ACS Catal.* **2022**, *12*, 4792. DOI: 10.1021/acscatal.1c05431
4. A. R. Poerwoprajitno, L. Gloag, J. Watt, S. Cheong, X. Tan, H. Lei, H. A. Tahini, A. Henson, B. Subhash, N. M. Bedford, B. K. Miller, P. B. O'Mara, T. M. Benedetti, D. L. Huber, W. Zhang, S. C. Smith,* J. J. Gooding,* W. Schuhmann,* R. Tilley* "A single-Pt-atom-on-Ru-nanoparticle electrocatalyst for CO-resilient methanol oxidation", *Nat. Catal.* **2022**, *5*, 231. DOI: 10.1038/s41929-022-00756-9
5. I. Kuschnerus, K. Giri, J. Ruan, Y. Huang, N. M. Bedford, A. Garcia-Bennett* "On the growth of the soft and hard protein corona of mesoporous silica particles with varying morphology", *J. Colloid Interface Sci* **2022**, *612*, 467. DOI: 10.1016/j.jcis.2021.12.161
6. E. C. Lovell,* J. Scott,* N. M. Bedford, T. H. Tan, P. J. Cullen, K. K. Ostrikov R. Amal "Two Steps Back, One Leap Forward: Synergistic Energy Conversion in Plasmonic and Plasma Catalysis", *ACS Ener. Lett* **2022**, *7*, 300 DOI: 10.1021/acsenergylett.1c02387
7. D. Zhang, C. Tsounis, Z. Ma, D. Djaidiguna, N. M. Bedford, L. Thomsen, X. Lu, D. Chu, R. Amal, Z. Han* "Highly Selective Metal-Free Electrochemical Production of Hydrogen Peroxide on Functionalized Vertical Graphene Edges", *Small* **2021**, *18*, 2105082 DOI: 10.1002/smll.202105082
8. Y. Cui, J. C. Rushing, S. Seifert, N. M. Bedford, D. G. Kuroda* "Structural and dynamical changes observed when transitioning from an ionic liquid to a deep eutectic solvent", *J. Chem. Phys.* **2021**, *155*, 054507 DOI: 10.1063/5.0053448
9. J. Jiang, C. Tsounis, L. C. Gallington, Y. Hu, R. W. J. Scott, J. A. Scott,* N. M. Bedford,* "Disordered TiO_x-SiO_x Nanocatalysts using Bioinspired Synthetic Routes", *ACS Appl. Ener. Mater.* **2021** DOI: 10.1021/acsaem.1c01025 **Supplemental Cover Article**
10. P. Ellersdorfer, T. C. Peterson,* G. Opletal,* N. M. Bedford,* "Extracting nanoscale structures from experimental and synthetic data with reverse Monte Carlo", *Nano Futures* **2021**, *5*, 022502. DOI: 10.1088/2399-1984/ac087b
11. W. H. Lie, C. Deng, Y. Yang, C. Tsounis, K.-H. Wu, M. V. Chandra-Hioe, N. M. Bedford,* D. Wang,* "High yield electrooxidation of 5-Hydroxymethyl furfural catalysed by unsaturated metal sites in CoFe Prussian Blue Analogue Films", *Green Chem.* **2021**, *23*, 4333. DOI: 10.1039/D1GC01208H
12. K. Wang, J. Liu, Z. Tang,* L. Li, M. Zubair, F. Ciucci,* L. Thomsen, J. Wright, N. M. Bedford,* "Establishing Structure/Property Relationships in Atomically Dispersed Co-Fe Dual Sites M-N_x Catalysts on Microporous Carbon for Oxygen Reduction Reaction", *J. Mater. Chem. A* **2021**, *9*, 13044 DOI: 10.1039/D1TA02925H (Part of HOT Papers collection)
13. Q. Zhang, P. Kumar, X. Zhu, R. Daiyan, N. M. Bedford, K.-H. Wu, Z. Han, T. Zhang, R. Amal,* X. Lu* "Electronically Modified Atomic Sites Within a Multicomponent Co/Cu

Composite for Efficient Oxygen Electroreduction”, *Adv. Ener. Mater.* **2021**, *11*, 2100303 DOI: 10.1002/aenm.202100303 **Featured on the back cover.**

14. M. H. Griep, M. S. Sellers, B. Subhash, A. M. Fakner, A L. West, N. M. Bedford,* “Towards the identification of the gold binding region within trypsin stabilized nanoclusters using microwave synthesis routes”, *Nanoscale* **2021**, *13*, 1061 DOI: 10.1039/D0NR07068H (Part of a Special Collection on Nanoscale Emerging Investigators 2021 & Editor’s Choice: Single-atom and nanocluster catalysis).
15. H. Iranmanesh, B. Subhash, D. J. Glover,* N. M. Bedford,* “Proteins and peptides for functional nanomaterials: Current efforts and new opportunities”, *MRS Bulletin* **2020**, *45*, 1005. DOI: 10.1557/mrs.2020.299
16. T. Zurrer, K. Wong, J. Horlyck, E. C. Lovell, J. Wright, N. M. Bedford, Z. Han, K. Liang, J. Scott,* R. Amal* “Mixed-Metal MOF-74 Templated Catalysts for Efficient Carbon Dioxide Capture and Methanation”, *Adv. Funct. Mater.* **2021**, *31*, 2007624. DOI: 10.1002/adfm.202007624
17. T. H Tan, B. Xie, Y. H. Ng, S. F. Binti Abdullah, H. Y. M. Tang, N. M. Bedford, R. A. Taylor, K.-F. Aguey-Zinsou, R. Amal, J. Scott* “Unlocking the Potential of the Formate Pathway in the Photo-assisted Sabatier Reaction”, *Nat. Catal.* **2020**, *3*, 1034. DOI: 10.1038/s41929-020-00544-3
18. Y. Cui, X. Tan, K. Xiao, S. Zhao, N. M. Bedford, Y. Liu, Z. Wang, K.-H. Wu, J. Pan, W. H. Saputera, S. Cheong, R. D. Tilley, S. C. Smith, J. Yun, L. Dai, R. Amal,* D.-W. Wang* “Tungsten Oxide/Carbide Surface Heterojunction Catalyst with High Hydrogen Evolution Activity”, *ACS Ener. Lett.* **2020**, *5*, 3560. DOI: 10.1021/acsenergylett.0c01858
19. X. Han, C. S. Gerke, S. Banerjee, M. Zubair, J. Jiang, N. M. Bedford, E. M. Miller, V. S. Thoi* “Strategic Design of MoO₂ Nanoparticles Supported by Carbon Nanowires for Enhanced Electrocatalytic Nitrogen Reduction”, *ACS Ener. Lett.* **2020**, *5*, 3237. DOI: 10.1021/acsenergylett.0c01857
20. J. J. Bowen, L. M. Rueschhoff, K. L. Matrin, D. P. Street, T. A. Patel, M. J. S. Parvulescu, N. M. Bedford, H. Koerner, S. Seifert, M. B. Dickerson* “Tailorable Micelle Morphology in Self-Assembling Block Copolymer Gels for Templating Nanoporous Ceramics”, *Macromolecules* **2020**, *53*, 7528. DOI: 10.1021/acs.macromol.0c01137
21. Q. Zhang, X. Tan, N. M. Bedford, Z. Han, L. Thomsen, S. Smith, R. Amal,* X. Lu* “Direct insights into the role of epoxy groups on cobalt sites for acidic H₂O₂ production”, *Nat. Comm.* **2020**, *11*, 4181. DOI: s41467-020-17782-5
22. C. Tsounis, X. Lu, N. M. Bedford,* B. Subhash, L. Thomsen, Q. Zhang, Z. Ma, K. Ostrikov, A. Bendavid, J. A. Scott, R. Amal, Z. Han* “Valence Alignment of Mixed Ni–Fe Hydroxide Electrocatalysts through Preferential Templating on Graphene Edges for Enhanced Oxygen Evolution”, *ACS Nano* **2020**, *14*, 11327. DOI: 10.1021/acsnano.0c03380
23. R. Daiyan, E. C. Lovell, B. Huang, M. Zubair, J. Leverett, Q. Zhang, S. Lim, J. Horlyck, J. Tang, X. Lu, K. Kalantar-Zadeh, J. N. Hart, N. M. Bedford,* R. Amal,* “Uncovering Atomic-Scale Stability and Reactivity in Engineered Zinc Oxide Electrocatalysts for Controllable Syngas Production”, *Adv. Ener. Mater.* **2020**, *10*, 2001381. DOI: 10.1002/aenm.202001381
24. Z. Ma, C. Tsounis, P. V. Kumar, Z. Han, R. J. Wong, C. Y. Toe, S. Zhou, N. M. Bedford, L. Thomsen, Y. H. Ng, R. Amal,* “Enhanced Electrochemical CO₂ Reduction of Cu@Cu_xO

Nanoparticles Decorated on 3D Vertical Graphene with Intrinsic sp³-type Defect”, *Adv. Funct. Mater.* **2020**, 30, 1910118. DOI: 10.1002/adfm.201910118

25. M Griep, N. M. Bedford,* “Amino-acid conjugated protein-Au nanoclusters with tuneable fluorescence properties”, *J. Phys. Mater.* **2020**, 3, 045002. DOI: 10.1088/2515-7639/ab8d90 (Part of a Special Issue on Emerging Leaders 2020)
26. M. J. Young,* N. M. Bedford, A. Yanguas-Gil, S. Letourneau, M. Colie, D. J. Mandia, B. Aoun, A. S. Covanagh, S. M. George, J. W. Elam,* “Probing the Atomic-Scale Structure of Amorphous Aluminum Oxide Grown by Atomic Layer Deposition”, *ACS Appl. Mater. Interfaces* **2020**, 12, 22804. DOI: 10.1021/acsami.0c01905
27. J. Veliscek-Carolan,* A. Rawal, D. T. Oldfield, G. J. Thorogood, N. M. Bedford, “Nanoporous Zirconium Phosphonate Materials with Enhanced Chemical and Thermal Stability for Sorbent Applications”, *ACS Appl. Nano Mater.* **2020**, 3, 3717. DOI: 10.1021/acsanm.0c00405
28. C. Hu, L. Gong, Y. Xiao, Y. Yuan, N. M. Bedford, Z. Xia, L. Ma, T. Wu, J. Lu, Y. Lin, J. W. Connell, L. Dai,* “High-Performance, Long-Life Rechargeable Li-CO₂ Batteries based on a 3D Holey Graphene Cathode Implanted with Iron Single Atoms”, *Adv. Mater.* **2020**, 32, 1907436. DOI: 10.1002/adma.201907436
29. I. Kuschnerus, M. Lau, K. Giri, N. M. Bedford, J. Biazik-Richmond, J. Ruan, A. Garcia-Bennett,* “Effect of a Soft Protein Corona on the Fibrinogen Induced Cellular Oxidative Stress of Gold Nanoparticles”, *Nanoscale*, **2020**, 12, 5898. DOI: 10.1039/D0NR00371A
30. R. Daiyan, R. Chen, P. Kumar, N. M. Bedford, J. Qu, J. Cairney, X. Lu, R. Amal,* “Tuneable Syngas Production through CO₂ Electroreduction on Cobalt-Carbon Composite Electrocatalyst”, *ACS Appl. Mater. Interfaces*, **2020**, 12, 9307. DOI: 10.1021/acsami.9b21216
31. H-S. Chen, T. M. Benedetti, V. R. Goncales, N. M. Bedford, R. W. J. Scott, R. F. Webster, S. Cheong, J. J. Gooding,* R. D. Tilley,* “Preserving the Exposed Facets of Pt₃Sn Intermetallic Nanocubes During an Order to Disorder Transition Allows the Elucidation of the Effect of the Degree of Alloy Ordering on Electrocatalysis”, *J. Amer. Chem. Soc.* **2020**, 142, 3231. DOI: 10.1021/jacs.9b13313
32. F. G. Baddour,* E. J. Roberts, A. To, L. Wang, S. E. Habas, D. A. Ruddy, N. M. Bedford, J. Wright, C. P. Nash, J. A. Schaidle, R. L. Brutchey,* N. Malmstadt,* “An Exceptionally Mild and Scalable Solution-Phase Synthesis of Molybdenum Carbide Nanoparticles for Thermocatalytic CO₂ Hydrogenation”, *J. Amer. Chem. Soc.* **2020**, 142, 1010. DOI: 10.1021/jacs.9b11238
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34. J. M. Slocik, P. B. Dennis, A. O. Govorov, N. M. Bedford, Y. Ren, R. R. Naik* “Chiral Restructuring of Peptide Enantiomers on Gold Nanomaterials”, *ACS Biomater. Sci Eng.* **2019**, 6, 2612. DOI: 10.1021/acsbiomaterials.9b00933
35. A. Walker,* M. Vratsanos, S. Kozawa, T. Askew, K. Hemmendinger, B. McGrail, N. M. Bedford, G. Wnek “Enhanced elasticity in poly (acrylic acid) gels via synthesis in the presence of high concentrations of select salts”, *Soft Matt.* **2019**, 15, 7596. DOI: 10.1039/C9SM01101C
36. L. Torres Jr., J. L. Daristotle, O. B. Ayyub, B. M. Bellato-Meinhardt, H. Garimella, A. Margaronis, S. Seifert, N. M. Bedford, T. J. Woehl, P. Kofinas,* “Structurally Colored

Protease Responsive Nanoparticle Hydrogels with Degradation-Directed Assembly”, *Nanoscale* **2019**, *11*, 17904. DOI: 10.1039/C9NR04624K

37. J. Horlyck, A. Nashira, E. Lovell, R. Daiyan, N. M. Bedford, Y. Wei, R. Amal, J. Scott,* “Plasma treating mixed metal oxides to improve oxidative performance via defect generation”, *Materials* **2019**, *12*, 2756. DOI: 10.3390/ma12172756
38. Y. Cui, K. Xiao, N. M. Bedford, X. Lu, J. Yun, R. Amal, D.-W. Wang,* “Refilling Nitrogen to Oxygen Vacancies in Ultrafine Tungsten Oxide Clusters for Superior Lithium Storage”, *Adv. Ener. Mater.* **2019**, *9*, 1902148. DOI: 10.1002/aenm.201902148
39. J. Horlyck, S. Pokhrel, E. Lovell, N. M. Bedford, L. Mädler,* R. Amal, J. Scott,* “Unifying Double Flame Spray Pyrolysis with Lanthanum Doping to Restrict Cobalt-Aluminate Formation in Co/Al₂O₃ Catalysts for the Dry Reforming of Methane”, *Catal. Sci. Techn.* **2019**, *9*, 4970. DOI:10.1039/C9CY01293A
40. Q. Zhang, N. M. Bedford, J. Pan, X. Lu,* R. Amal,* “A Fully Reversible Water Electrolyzer Cell Made Up from FeCoNi (Oxy)hydroxide Atomic Layers”, *Adv. Ener. Mater.* **2019**, *9*, 1901312. DOI: 10.1002/aenm.201901312
41. R. Daiyan, E. C. Lovell, N. M. Bedford, W. H. Saputera, K.-S. Wu, S. Lim, J. Horlyck, Y. H. Ng, X. Lu,* R. Amal,* “Modulating Activity through Defect Engineering of Tin Oxides for Electrochemical CO₂ Reduction”, *Adv. Sci.* **2019**, *6*, 1900678. DOI: 10.1002/advs.201900678
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43. Y. Cui, J. C. Rushing, S. Seifert, N. M. Bedford, D. G. Kuroda,* “The Molecularly Heterogeneous Structure of a Non-Ionic Deep Eutectic Solvent Composed of N-Methylacetamide and Lauric Acid”, *J. Phys. Chem B* **2019**, *123*, 3984. DOI: 10.1021/acs.jpcc.8b11732
44. J. Liu, Z. Li, X. Zhang, K. Otake, L. Zhang, A. W. Peters, M. J. Young, N. M. Bedford, S. P. Letourneau, D. J. Mandia, J. W. Elam, O. K. Farha,* J. T. Hupp,* “Introducing Nonstructural Ligands to Zirconia-like MOF Nodes to Tune the Activity of Node-Supported Nickel Catalysts for Ethylene Hydrogenation”, *ACS Catal.* **2019**, *9*, 3198. DOI: 10.1021/acscatal.8b04828
45. W. H. Saputera, H. A. Tahini, M. Sabsabi, T. H. Tan, N. M. Bedford, E. Lovell, Y. Cui, J. N. Hart, D. Friedmann, S. C. Smith, R. Amal,* J. Scott,* “Light Induced Synergistic Defects on TiO₂/SiO₂ Composites for Oxygen Activation”, *ACS Catal.* **2019**, *9*, 2674. DOI: 10.1021/acscatal.8b04891
46. M. J. Young,* ,T. Kiryutina, N. M. Bedford,* T. J. Woehl, C. S. Segre, “Discovery of Anion Insertion Electrochemistry in Layered Hydroxide Nanomaterials”, *Sci. Reports* **2019**, *9*, 2462. DOI: 10.1038/s41598-019-39052-1
47. K. Wang, W. Wu, Z. Tang,* L. Li, S. Chen, N. M. Bedford,* “Hierarchically Structured Co(OH)₂/CoPt/N-CN Air Cathodes for Rechargeable Zinc-Air Batteries”, *ACS Appl. Mater. Interfaces* **2019**, *11*, 4983. DOI: 10.1021/acsami.8b18424
48. X. Han, M. Wang, M. L. Le, N. M. Bedford, T. J. Woehl, V. S. Thoi,* “Effects of Substrate Porosity in Carbon Aerogel Supported Copper for Electrocatalytic Carbon Dioxide Reduction”, *Electrochim. Acta* **2019**, *297*, 545. DOI: 10.1016/j.electacta.2018.11.203

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50. M. K. Gupta, K. A. Becknell, M. G. Crosby, N. M. Bedford, J. Wright, P. B. Dennis,* R. R. Naik,* "Programmable Mechanical Properties from a Worm Jaw-Derived Biopolymer through Hierarchical Ion Exposure", *ACS Appl. Mater. Interfaces* **2018**, *10*, 31928. DOI: 10.1021/acсами.8b10107
51. S. Letourneau, M. J. Young, N. M. Bedford, Y. Ren, A. Yanguas-Gil, A. U. Mane, J. W. Elam, E. Graugnard,* "Structural evolution of molybdenum disulfide prepared by atomic layer deposition for realization of large scale films", *ACS Appl. Nano Mater.* **2018**, *1*, 4028. DOI: 10.1021/acsanm.8b00798
52. A. Baumann, G. Aversa, A. Roy, N. M. Bedford, M. Falk, V. S. Thoi,* "Probing Sulfur Interactions in Cu-based Metal Organic Frameworks for Lithium Sulfur Batteries", *J. Mater. Chem. A* **2018**, *6*, 4811. DOI: 10.1039/C8TA01057A
53. A. E. Garcia-Bennett,* M. Lau, N. M. Bedford, "Probing the amorphous state of pharmaceutical compounds within mesoporous material", *J. Pharma. Sci.* **2018**, *107*, 2216. DOI: 10.1016/j.xphs.2018.03.029
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65. B. D. Briggs†, N. M. Bedford†, S. Seifert, H. Koerner, H. Ramezani-Dakhel, H. Heinz, A. I. Frenkel, R. R. Naik,* M. R. Knecht,* "C-C Coupling of Peptide-Capped Pd Nanoparticle Progresses Through an Atom Leeching Mechanism", *Chem. Sci* **2015**, *6*, 6413. DOI: 10.1039/C5SC01424G †Equal author contribution
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67. N. M. Bedford,* H. Ramezani-Dakhel, J. M. Slocik, B. D. Briggs, Y. Ren, A. I. Frenkel, V. G. Petkov, H. Heinz,* R. R. Naik,* M. R. Knecht,* "Elucidation of Biologically Programmed Atomic-Scale Structure of Nanoparticle Interfaces that Modulates Catalytic Activity", *ACS Nano* **2015**, *9*, 5082. DOI: 10.1021/acsnano.5b00168 **Featured on the front cover**
68. J. D. Torrey, J. P. Killgore, N. M. Bedford, L. F. Greenlee,* "Oxidation Behavior of Zero-Valent Iron Nanoparticles in Mixed Matrix Water Purification Membranes", *Environ. Sci. Water Res. Technol.* **2015**, *1*, 146. DOI: 10.1039/C4EW00068D **Featured on the inside front cover**
69. N. M. Bedford, R. Bhandari, J. M. Slocik, S. Seifert, R. R. Naik, M. R. Knecht,* "Peptide-Modified Dendrimers as Templates for the Production of Highly Reactive Catalytic Nanomaterials", *Chem. Mater.* **2014**, *26*, 4082. DOI: 10.1021/cm5007444
70. E. M. Zahran, N. M. Bedford, M. A. Nguyen, Y.-J. Chang, B. S. Guiton, R. R. Naik, L. G. Bachas, M. R. Knecht,* "Light Driven Tandem Catalysis Driven by Multicomponent Nanomaterials", *J. Amer. Chem. Soc.* **2013**, *136*, 32. DOI: 10.1021/ja410465s
71. M. B. Dickerson, A. A. Sierra, N. M. Bedford, W. Lyon, W. E. Gruner, P. A. Mirau, R. R. Naik,* "Keratin-Based Antimicrobial Textiles, Films, and Nanofibers", *J. Mater. Chem. B* **2013**, *1*, 5505. DOI: 10.1039/C3TB20896F
72. R. Bhandari, D. B. Pacardo, N. M. Bedford, R. R. Naik, M. R. Knecht,* "Peptide Templated Metallic Nanoparticles for Catalytic Allyl Alcohol Hydrogenation", *J. Phys. Chem. C*, **2013**, *117*, 18053. DOI:10.1021/jp403796h

73. R. Coppage, J. M. Slocik, H. Ramezani-Dakhel, N. M. Bedford, R. R. Naik, M. R. Knecht,* "Exploiting Localized Surface Binding Effects to Enhance the Catalytic Reactivity of Peptide-Capped Nanoparticles", *J. Amer. Chem. Soc.* **2013**, *135*, 11048. DOI: 10.1021/ja402215t
74. N. M. Bedford, M. Pelaez, C. Han, D. D. Dionysiou, A. J. Steckl,* "Photocatalytic cellulosic electrospun fibers for the degradation of potent cyanobacteria toxin microcystin-LR", *J. Mater. Chem.* **2012**, *22*, 12666. DOI: 10.1039/C2JM31597A **Published as HOT Article by RSC**
75. N. M. Bedford, M. B. Dickerson, L. F. Drummy, H. Koerner, K. M. Singh, M. C. Vasudev, M. F. Durstock, R. R. Naik,* A. J. Steckl,* "Nanofiber-Based Bulk-Heterojunction Organic Solar Cells Using Coaxial Electrospinning", *Adv. Ener. Mater.* **2012**, *2*, 1136. DOI: 10.1002/aenm.201100674
76. D. Shi,* N. M. Bedford, H. S. Cho, "Engineered Multifunctional Nanocarriers for Cancer Diagnosis and Therapeutics", *Small* **2011**, *7*, 2549. DOI: 10.1002/smll.201100436
77. N. M. Bedford, G. D. Winget, S. Punnamaraju, A. J. Steckl,* "Immobilization of Stable Thylakoid Vesicles in Conductive Nanofibers by Electrospinning", *Biomacromolecules* **2011**, *12*, 778. DOI: 10.1021/bm101386w
78. N. M. Bedford, A. J. Steckl,* "Photocatalytic Self Cleaning Textile Fibers by Coaxial Electrospinning", *ACS Appl. Mater. & Interfaces* **2010**, *2*, 2448. DOI: 10.1021/am1005089
79. N. M. Bedford,* "Analysis of 3D structures of platinum nanoparticles by high energy X-ray diffraction and reverse Monte Carlo simulations", *Solid State Comm.* **2010**, *150*, 1505. DOI: 10.1016/j.ssc.2010.06.020
80. V. Petkov,* N. Bedford, M. R. Knecht, M. G. Weir, R. M. Crooks, W. Tang, G. Henkelman, and A. Frenkel, "Periodicity and Atomic Ordering in Nanosized Particles of Crystals", *J. Phys. Chem. C* **2008**, *122*, 8907. DOI: 10.1021/jp801195c
81. N. Bedford, C. Dablemont, G. Viau, P. Chupas, and V. Petkov,* "3D Structure of Nanosize Catalysts by High-Energy XRD and RMC Simulations: Study of Ru", *J. of Phys. Chem. C* **2007**, *111*, 18214. DOI: 10.1021/jp0752062

Textbooks

1. D. Shi, Z. Gui, N. Bedford, "Nanomaterials and Devices" Elsevier Publishing (Oxford) **2015**.

Presentations:

Invited Conference Presentations

1. "Designing Functional Nanomaterials for Infield Energy Generation from a Wide Array of Water Sources", 2021 International Materials Research Congress, Cancun, Mexico in August of 2021, symposium held virtually in August of 2021
2. "Making Sense of Atomically-Complex Nanoscale Materials by Stochastic Modeling of Pair Distribution Functions", Denver X-ray Conference, held virtually in August of 2021
3. "Engineering Inorganic Nanoparticles with Proteins: New Possibilities for SynBio?", CSIRO Synthetic Biology for Bio-Based Materials Symposium, held virtually in June of 2021
4. "Using Synchrotron Radiation Characterization Methods to Undercover Structural Phenomena in Reactive Nanomaterials and Interfaces", 2019 International Materials Research Congress, Cancun, Mexico in August of 2019

5. "Understanding Structure at the Biotic/Abiotic Interface: Issues in Current Characterization Methods and Future Opportunities using Soft X-ray Characterization Methods", Advanced Light Source 2018 User Meeting, Berkeley, CA, USA in October of 2018
6. "Leveraging Biological Molecules for Functional Inorganic Nanomaterials Development via Atomic-Scale Structural Characterization", 2018 International Materials Research Congress, Cancun, Mexico in August of 2018
7. "Optimization of Human-Performance Biosensors: Opportunities in RSoXS and NEXAFS to Elucidate Biomolecular Structure/Function Relationships for Future Sensor Design", 2017 NSLS-II & CFN Users' Meeting, Brookhaven National Laboratory, Upton, NY, USA in May of 2017
8. "Predictive Materials Properties through the Establishment of Bio-Inspired Rational Design Rules," US-Australia Enabling Technologies Meeting, Sydney, NSW, Australia in May 2016
9. "Predictive Materials Properties through the Establishment of Bio-Enabled Rational Design Rules," US-Australia Enabling Technologies Meetings, Arlington, VA, USA in May 2015

Invited Seminars

1. "Developing Functional Nanomaterials through Atomic-Scale Structural Elucidation", School of Materials Science and Engineering, Nanyang Technical University, Singapore in May of 2022.
2. "Elucidation of Structure/Property Relationships for Electrocatalysis Using In-situ Synchrotron Methodologies", Army Research Laboratory, Maryland, USA in May of 2022.
3. "Efforts in Rational Material Design through Synchrotron Characterization", Department of Mechanical and Process Engineering, ETH Zurich, Zurich, Switzerland, in March of 2022.
4. "Solving the "Structure/Function Relationship" Problem for Nanoscale Materials using Synchrotron Characterization Methods", Department of Mechanical and Materials Engineering, University of Cincinnati, Cincinnati, OH in February of 2022 (held virtually).
5. "Elucidating Atomic Scale Structure for Functional Nanomaterials: Toward Rational Design through Fundamental Science", School of Chemical Engineering, University of Queensland, Brisbane, QLD in April of 2021 (held virtually).
6. "Understanding Structure/Function Relationships for Catalytic Systems using In-Situ Synchrotron Techniques", Department of Biomedical, Biological, and Chemical Engineering, University of Missouri, Columbia, MO in November of 2020 (held virtually).
7. "Discovery of Atomic-Scale Structure/Function Relationships in Nanoscale Materials using Synchrotron Radiation Characterization Methods", Department of Chemistry, Technical University of Berlin, Berlin, Germany in May of 2019
8. "Discovery of Atomic-Scale Structure/Function Relationships in Nanoscale Materials using Synchrotron Radiation Characterization Methods", Centre for Clean Environment and Energy, Griffith University, Gold Coast, QLD, Australia in May of 2019
9. "Using Synchrotron Radiation Characterization Methods to Undercover Structural Phenomena in Reactive Nanomaterials and Interfaces", Edgewood Chemical and Biological Center, US Army, Edgewood, MD, USA in March of 2019

10. "Identification of Atomic-Scale Structural Motifs Responsible for Materials Properties using Synchrotron Radiation Characterization Methods", Department of Materials Science and Engineering, Boise State University, Boise, ID, USA in November of 2018
11. "Identification of Important Atomic-Scale Structural Motifs Responsible for Materials Properties using Synchrotron Radiation Characterization Methods", Institute for Superconducting and Electronic Materials, University of Wollongong, Wollongong, NSW, Australia, in June of 2018
12. "Nanomaterials Development using Structure/Function Relationship Established by Synchrotron Radiation Characterization Techniques", Department of Chemistry and Biological Science, Macquarie University, Sydney, NSW, Australia in May of 2018
13. "Development of Structure/Function Relationships for Catalytic Nanomaterials using Atomic-Scale Synchrotron Radiation Characterization Methods", Department of Chemical Engineering, University of Toledo, Toledo, OH, USA in November of 2017
14. "Understanding Structure/Function Relationships of Nanomaterials using Atomic-Scale Synchrotron Radiation Characterization Methods", School of Mathematical and Physics Sciences, University of Technology Sydney, Sydney, NSW, Australia in October of 2017
15. "Biotic/Abiotic Interface Manipulation of Functional Nanomaterials: Toward Rational Engineering of Enhanced Materials Using Structure/Function Relationship Development", School of Chemical Engineering, University of New South Wales, Sydney, NSW Australia in August of 2017
16. "Nanocatalyst Design Using Peptide-Enabled Synthetic Routes & Atomic-Scale Structure Characterization Methods", Department of Chemical Engineering, Auburn University, Auburn, AL, USA in February of 2017
17. "Nanocatalyst Design Using Peptide-Enabled Synthetic Routes & Atomic-Scale Structure Characterization Methods", Department of Materials Science and Engineering, Boise State University, Boise, ID, USA in January of 2017
18. "Research Activities at the Materials and Manufacturing Directorate and Future Collaborative Possibilities at NSLS-II", National Synchrotron Light Source, Brookhaven National Laboratory, Upton, NY, USA in December of 2016
19. "Complete Atomic-Scale Structure Elucidation of Nanoscale Materials: Toward Rational Materials Design", Department of Materials Engineering, Auburn University, Auburn, AL, USA in December of 2016
20. "Rational Design of Nanoscale Materials Using Synchrotron Characterization Techniques", Department of Chemistry, US Naval Academy, Annapolis, MD, USA in September of 2016
21. "Atomic-Scale Structure Elucidation of Nanoscale Materials Using Synchrotron Irradiation Techniques", Institute of Frontier Materials, Deakin University, Waurn Ponds, VIC, Australia in May of 2016
22. "Atomic-Scale Structure Elucidation of Nanoscale Materials Using Synchrotron Irradiation Techniques", Australian Nuclear Science and Technology Organisation, Lucas Heights, NSW, Australia in May of 2016
23. "Atomic-Scale Structure Elucidation of Nanoscale Materials Using Synchrotron Irradiation Techniques", School of Chemistry, University of Sydney, Sydney, NSW, Australia in May of 2016

24. "Complete Atomic-Scale Structure Elucidation of Nanoscale Materials Using Synchrotron Radiation Characterization Methods: Toward Rational Materials Design", Department of Chemistry, University of New Orleans, New Orleans, LA, USA in April of 2016
25. "Complete Atomic-Scale Structure Elucidation of Nanoscale Materials Using Synchrotron Radiation Characterization Methods: Toward Rational Materials Design", Department of Macromolecular Science and Engineering, Case Western Reserve University, Cleveland, OH, USA in March of 2016
26. "Using Advanced Atomic-Scale Structural Characterization Methods with Bio-Inspired Synthesis Routes for the Generation of Highly Active Nanocatalysts", Department of Chemistry, Johns Hopkins University, Baltimore, MD, USA in January of 2016
27. "Understanding Atomic-Scale Structure/Function Relationships of Peptide-Enabled Nanomaterials: Toward Bio-Inspired Optimization of Materials Properties", NIST Center for Neutron Research, Gaithersburg, MD, USA in January of 2016
28. "Peptide-Enabled Nanomaterials with Optimized Properties via Atomic-Scale Structural Characterization of the Biotic/Abiotic Interface", Advanced Photon Source User Seminar, Argonne National Laboratory, IL, USA in August of 2015
29. "Peptide-Enabled Nanomaterials with Optimized Properties via Atomic-Scale Structural Characterization of the Biotic/Abiotic Interface," Department of Chemical Engineering, University of Arkansas, AR, USA in June of 2015.
30. "Using High-Energy Synchrotron-Based Methods to Uncover Tunable Properties of Peptide-Enabled Nanomaterials," Department of Chemical Engineering, Kansas State University, Manhattan, KS, USA in April of 2015.
31. "Using Bio-Inspired Synthesis Methods to Understand Structure/Function Relationships for Catalytic Nanoparticles," Department of Chemistry, Central Michigan University, Mount Pleasant, MI, USA in February of 2015.
32. "Exploiting Biology to Achieve Rationally-Designed Nanomaterials with Optimized/User Defined Properties," Applied Chemical and Materials Division, National Institute of Standards and Technology, Boulder, CO, USA in December of 2014.

Scientific Conferences

1. "Defect Engineered 2D Layered Double Hydroxides for Biomass Electrooxidation Reactions," Materials Research Society Spring Meeting, Honolulu, HI, USA in May 2022.
2. "Using in-situ Synchrotron Characterization Methods to Understand Structure/Function Relationships for Catalytic Nanomaterials," American Institute of Chemical Engineers Annual Meeting, Orlando, FL, USA in November 2019.
3. "In-situ Atomic Scale Structure Elucidation of Nanocatalyst under Electrochemical Conditions using XAS and PDF Analysis," European Materials Research Society Spring Meeting, Nice, USA in May 2019.
4. "Leveraging Biology for Functional Inorganic Nanomaterials Development," American Institute of Chemical Engineers Annual Meeting, Pittsburgh, PA, USA in October 2018.

5. "Development of Sequence-Dependent Structure/Function Relationships for Peptide-Enabled Nanomaterials," American Chemical National Society Meeting, New Orleans, LA, USA in March 2018.
6. "Elucidating Morphology and Orientation of Biomolecules on 2D Nanomaterials for Real-Time Flexible FET Biosensors," Materials Research Society Fall Meeting, Boston, MA, USA in November/December 2017
7. "Disordered Mixed Metal Oxide Nanocatalysts for the Oxygen Evolution Reaction Using Bio-enabled Synthetic Routes," Materials Research Society Fall Meeting, Boston, MA, USA in November/December 2017
8. "Manipulation of Bimetallic Nanoparticle Surfaces through Peptide-Enabled Synthetic Strategies," Materials Research Society Fall Meeting, Boston, MA, USA in November/December 2017
9. "Elucidation of Sequence-Dependent Structure/Function Relationships for Bio-Enabled Nanoparticles," Denver X-Ray Conference, Westminster, CO, USA in August 2015
10. "Sequence-Dependent Structure/Function Elucidation of Peptide-Enabled Nanoparticles Using a Combined Experimental/Computational Approach," Materials Research Society Spring Meeting, San Francisco, CA, USA in April 2015
11. "Sequence-Dependent Structure/Function Elucidation of Peptide-Enabled Nanoparticles Using a Combined Experimental/Computational Approach," American Chemical Society National Meeting, Denver, CO, USA in March 2015
12. "Non-Platinum Group Metal Bimetallic Electrocatalyst for Alternative Fuel Oxidation and Ammonia Production," American Chemical Society National Meeting, Denver, CO, USA in March 2015
13. "Structure/Function Analysis of Peptide-Capped Pd Nanoparticles Using High-Energy X-Ray Characterization Techniques," Materials Research Society Fall Meeting, Boston, MA, USA in December of 2013.
14. "Pd Nanomaterials Templated by R5-PAMAM Dendrimer Conjugates," American Chemical Society National Meeting, New Orleans, LA, USA in April of 2013.
15. "Photocatalytic Textile Fibers by Coaxial Electrospinning," Materials Research Society Fall Meeting, Boston, MA, USA in December of 2009.
16. "Electrospun Biopolymer-Based Micro/Nanofibers," University Government Industry Micro/Nano Symposium, Louisville, KY, USA in July of 2008.

Poster Presentations

1. "Elucidation of Atomic-Scale Structure/Function Relationships: Toward Predictive and Rational Design of Nanoscale Materials," AIChE Annual Meeting, San Francisco, CA, USA in November 2016
2. "Elucidation of Sequence-Dependent Structure/Function Relationships for Monometallic and Bimetallic Nanoparticles: Toward the Establishment of Bio-Inspired Rational Design Rules," NIST Chapter of Sigma XI, 23rd Annual Postdoc Poster Forum, Gaithersburg, MD, USA in February 2016 (**BEST POSTER, MATERIALS CATEGORY**)

3. "In-situ Structural Determination of Monometallic and Bimetallic Nanoparticles During Electrocatalysis Using High-Energy X-Ray Diffraction, Pair Distribution Function Analysis, and X-Ray Adsorption Spectroscopy," Materials Research Society Spring Meeting, San Francisco, CA, USA in April 2015
4. "Structure/Function Elucidation of Aqueous-Based Monometallic and Bimetallic Nanocatalysts," Gordon Research Conference: Nanomaterials for Applications in Energy Technologies, Ventura, CA, USA in February 2015
5. "Structure/Function Analysis of Peptide-Capped Pd Nanoparticles Using High-Energy X-Ray Characterization Techniques," International Conference on Frontiers of Polymers and Advanced Materials, Auckland, New Zealand in December of 2013.
6. "Peptide-Modified Dendrimers as Templates for the Production of Highly Reactive Catalytic Nanomaterials," Materials Research Society Fall Meeting, Boston, MA, USA in December of 2013.
7. "Detection of Microcystin-LR Using Peptide Functionalized Au Nanoparticles," Materials Research Society Spring Meeting, San Francisco, CA, USA in April of 2012.
8. "Toward Colorimetric Chemical and Biological Sensing Using Bio-Functionalized Polydiacetylenes," Chemical and Biological Defense Science and Technology Meeting, Las Vegas, NV, USA in November of 2011.
9. "Degradation of Potent Cyanobacteria Toxin Microcystin-LR Using Photocatalytic Cellulosic Electrospun Fibers," IGERT Regional Symposium, Cincinnati, OH, USA in September 2011.
10. "Fiber-Based Bulk-Heterojunction Solar Cells Using Coaxial Electrospinning," University Clean Energy Alliance of Ohio 5th Annual Conference, Columbus, OH, USA in April 2011.
11. "Toward Colorimetric Chemical and Biological Sensing Using Bio-Functionalized Polydiacetylenes," Chemical and Biological Defense Science and Technology Meeting, Orlando, FL, USA in November of 2010.
12. "Photocatalytic Cellulosic Micro/Nano-Fibers by Electrospinning," Nanofibers for the 3rd Millennium, Raleigh, NC, USA in August of 2010 (**3rd Prize overall**).
13. "Fiber-Based Bulk-Heterojunction Solar Cells Using Coaxial Electrospinning," Central Region Meeting of the American Chemical Society, Dayton, OH, USA in June of 2010.
14. "Electrospun P3HT/PCBM Fiber-Based Bulk-Heterojunction Solar Cells," Materials Research Society Spring Meeting, San Francisco, CA, USA in April of 2010.
15. "Applications of Electrospun Nano/Micro Fibers for Textiles, Optoelectronics & Biotechnology," Materials Research Society Fall Meeting, Boston, MA, USA in December of 2009 (**1st Prize, Symposium WW**).
16. "Core/Sheath Micro/Nanofibers by Coaxial Electrospinning," Ohio Innovation Summit, Dayton, OH, USA in April of 2009.
17. "Core/Sheath Micro/Nanofibers by Coaxial Electrospinning," 5th Annual Science & Engineering Expo, Cincinnati, OH, USA in March of 2009 (**Invited Poster**).
18. "Core/Sheath Micro/Nanofibers by Coaxial Electrospinning," University of Cincinnati Graduate School Poster Forum, Cincinnati, OH, USA in March of 2009 (**Best Poster Award**).

19. "3-Dimensional Structure of Metallic Nanoparticles Using High Energy X-Ray Diffraction and Reverse Monte Carlo Simulations," Materials Research Society Spring Meeting, San Francisco, CA, USA in March of 2008.
20. "3D Structure of Nanoparticles by Reverse Monte Carlo Simulation," Student Research & Creative Endeavors Exhibition, Mt. Pleasant, MI, USA in April of 2007.
21. "3D Structure of Nanoparticles by Reverse Monte Carlo Simulation," Central Michigan University's Posters at the Capitol, Lansing, MI, USA in April of 2007.
22. "Hydrodynamic Radii of PPI Dendrimers in Various Solvents," Student Research & Creative Endeavors Exhibition, Mt. Pleasant, MI, USA in April of 2006.
23. "Diffusion NMR Study of Dendrimer Encapsulation," International Dendrimer Symposium, Mt. Pleasant, MI, USA in May of 2005.

Teaching Experience

- *University of New South Wales*
 - Lecturer & Course Coordinator, Engineering PGCW Research Skills (GSOE9011), 2021-current
 - Lecturer & Course Coordinator, Advanced Thermodynamics and Separations (CEIC 3001), 2019-current
 - Lecturer, Chemical Reaction Engineering (CEIC 2005), 2018-current
 - Laboratory Supervisor, Chemical Engineering Lab A (CEIC 2007), 2018-current
 - Course Coordinator, Industrial Chemistry for Chemical Engineering (CEIC 2004), 2019
- *University of Miami*
 - Instructor, Principles of Chemistry I (CHM 111), Summer Semester 2014
 - Guest lecturer, Introduction to Nanotechnology (taught by Dr. Marc Knecht), Spring Semester 2014
- *University of Cincinnati*
 - Teaching assistant, Advanced Microfabrication of Compound Semiconductor Devices (taught by Dr. Andrew Steckl), Winter Quarter 2011
 - Teaching assistant, Microfabrication of Semiconductor Devices (taught by Dr. Andrew Steckl), Fall Quarter 2010
 - Teaching assistant, Basic Heat Transfer (taught by Dr. Paul Phillips), Spring Quarter 2008
 - Teaching assistant, Soft Matter (taught by Dr. Dale Schaefer), Spring Quarter 2008
 - Teaching assistant, Intro Thermodynamics (taught by Dr. Dale Schaefer), Spring Quarter 2008
 - Teaching assistant, Diffusion and Kinetics (taught by Dr. Jainagesh Sekhar), Winter Quarter 2008
 - Head teaching assistant, Intro to Metals (taught by Dr. Donglu Shi), Fall Quarter 2007
 - Teaching assistant, Intro to Chemical Engineering Lab (taught by Dr. Vesselin Shanov), Fall Quarter 2007
- *Central Michigan University*
 - Undergraduate Laboratory Assistant, Organic Chemistry and General Chemistry, 2005-2007.

Mentorship & Management

- Supervisor – UNSW School of Chemical Engineering (2018 – current)
 - 12 current PhD candidates at UNSW, 1 co-supervised student at Griffith University with Huijun Zhao

- 4 current undergraduate honors thesis students
 - 10 undergraduate honors student theses successfully completed
- 15 undergraduate students on Vertically Aligned Program from Chemical Engineering, Civil Engineering, Materials Science, and Chemistry
- Supervisor – NIST Summer High School Intern Program (SHIP), 2015
- Supervisor – NIST Summer Undergraduate Research Fellowship (SURF), 2015
- Mentor – Science Research Seminar, Monarch High School (Louisville, CO), 2015-16

Professional Activities

Proposal Reviewer

- Ad-hoc reviewer for the American Chemical Society Petroleum Research Fund (ACS PRF)
- Ad-hoc reviewer for the US Department of Energy Basic Energy Sciences (DOE-BES)
- Ad-hoc reviewer for Australian Synchrotron beam time proposals
- Ad-hoc reviewer for Stanford Synchrotron Radiation Lightsource (SSRL) beam time proposals
- Moderator for the UNSW Scientia PhD Scheme
- Panel reviewer for the Catalysis and Biocatalysis program of the CBET Division at NSF (2016, 2017)

Journal Reviewer:

- *Advanced Materials*
- *Advanced Functional Materials*
- *Angewandte Chemie International Edition*
- *ACS Nano*
- *Journal of the American Chemical Society*
- *Advanced Optical Materials*
- *Chemistry of Materials*
- *ACS Energy Letters*
- *Small*
- *ACS Applied Materials and Interfaces*

Memberships:

- American Institute of Chemical Engineers, 2017-present
- American Chemical Society, 2010-present
- Materials Research Society, 2008-present
- Vice President, Graduate Student Governance Associated (Materials Engineering Chapter), University of Cincinnati, 2008-2011
- Secretary, Graduate Student Governance Associated (Materials Engineering Chapter), University of Cincinnati, 2007-2008
- Sigma Phi Sigma (Physics Honors Society), Central Michigan University Chapter, 2007
- Treasurer, Central Michigan University Society of Physics Students, 2004-2006

Awards and Honors

- National Research Council Research Associateship, 2012-2014
- The Dayton Area Graduate Studies Institute Fellowship Award, 2009-2011
- Best Poster, Materials Category, NIST 23rd Annual Postdoc Poster Forum
- 3rd Prize Poster Award, Nanofibers for the 3rd Millennium, 2010
- 1st Prize Poster Award, Symposium WW, MRS Fall Meeting 2009

- Best in Show Award, 2009 University of Cincinnati Graduate School Poster Forum
- University Graduate Scholarship, University of Cincinnati, 2007-2008
- College of Science and Technology Summer Scholarship Award, 2006

References

- Richard Tilley, Ph.D.
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