JONG-BEOM BAEK

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Short Biography

Jong-Beom Baek is a distinguished professor/director of the Department of Energy and Chemical Engineering/Center for Dimension-Controllable Organic Frameworks, Ulsan National Institute of Science and Technology (UNIST), South Korea. After awarding his Ph.D. degree from Polymer Science, University of Akron (USA, 1998), he joined the Wright-Patterson Air Force Research Laboratory (AFRL). Then, he returned to his home country to take up a position as an assistant professor at Chungbuk National University (CBNU) in 2003, before moving to UNIST in 2008. His current research interests include the syntheses of two- and three-dimensional high-performance organic network structures as platforms for energy conversion and storage applications, and mechanochemistry as a new method for sustainable applications. He has authored and co-authored over 300 peer-reviewed publications in the areas of mechanochemistry, ammonia, hydrogen, polymer chemistry, and electrocatalysis. He has also registered and filed over 80 international and domestic patents. Some of them have been transferred to industries with over 1 billion KRW ($1M USD) for commercialization and also started his own company RuC2N in 2018 (www.ruc2n.con).

Education

1994-98 University of Akron, Akron, Ohio, Polymer Science, Ph. D.
1991-93 Kyungpook National University, Taegu, Korea, Polymer Science and Engineering, M. En.
1984-91 Kyungpook National University, Taegu, Korea, Industrial Chemistry, B. En.

Appointments

2023-09 Visiting Professor with Mercator Fellowship, Technical University of Dresden, Chair of Molecular Functional Materials
2022-11 Distinguished Professor, Ulsan National Institute of Science and Technology, Department of Energy & Chemical Engineering
2014-12 Director, Creative Research Initiative (CRI) Center for Dimension-Controllable Organic Frameworks (Research Program for Leading Scientists in Korea)
2010-04 Director, Low-Dimensional Carbon Materials Center
2008-08 Professor, Ulsan National Institute of Science and Technology, Department of Energy & Chemical Engineering
2016-08 Visiting Scholar, Pacific Northwest National Laboratory (PNNL)
2008-08 Visiting Scholar, Georgia Institute of Technology, Atlanta, GA
2003-09 Assistant ~ Associate Professor, Chungbuk National University, Department of Industrial Chemistry
1999-03 Research Chemist, US Air Force Research Lab/UDRI, WPAFB, OH
1998-99 Research Associate, Liquid Crystal Institute, Kent State University, Kent, OH

Honors and Awards

2024 **The Korea Technology Laureate (President Award)**
2023 **The Grand Award of Ulsan Citizen**
2023 **The National Academy of Science Laureate**
2023 Selected **2023 Highly Cited Researcher (HCR)**, Clarivate Analytics
2022 Selected **2022 Highly Cited Researcher (HCR)**, Clarivate Analytics
2021 Selected **2021 Highly Cited Researcher (HCR)**, Clarivate Analytics
2020 Selected **2020 Highly Cited Researcher (HCR)**, Clarivate Analytics

2019 Selected **2019 Highly Cited Researcher (HCR)**, Clarivate Analytics
2018 Selected **2018 Highly Cited Researcher (HCR)**, Clarivate Analytics
2022 Selected Top 12 Outstanding Researches, Ministry of Science & ICT
2022 Selected Top 100 Outstanding Researches, Ministry of Science and ICT
2022 **TORAY Science and Technology Laureate**
2021 Prime Minister Award for Grand Energy Challenge
2021 Academician of the **Korean Academy of Science and Technology (KAST)**, Korea
2020 **Korean Scientist of the Month** (November, 2020)-MIST, Korea
2020 **LG Chemicals Researcher Award**-PSK
2023 Editorial Board Member of *Small*
2022 Editorial Board Member of *Accounts of Materials Research*
2022 Editorial Board Member of *DeCarbon*
2020 Editorial Board Member of *Materials Advances*
2020 Editorial Board Member of *Journal of Materials Chemistry A*
2016 Editorial Board Member of *Energy Storage Materials*
2016 Editorial Board Member of *FlatChem*
2011 Associate Editor of *Carbon Letters*
2011 Editorial Board Member of *Materials Research Express*
2008 Editorial Board Member of *Macromolecular Research*
2017 Selected Top 10 Nanotechnologies in Korea, Korea Nano Technology Research Society (KONTRS)
2016 Minister Award for Top 10 Outstanding Researchers, Ministry of Science, ICT & Future Planning
2016 Selected Top 100 Outstanding Researches, Ministry of Science, ICT & Future Planning
2015 Selected Top 10 Science News in Korea, Korean Federation of Science and Technology Societies (KOFST)
2015 Minister Award for Outstanding Researchers, Ministry of Science, ICT & Future Planning
2013 Minister Award for Outstanding Researchers, Ministry of Economy and Knowledge (MEK)
2011 Outstanding Research Award, National Research Foundation (NRF), Korea
2011 Outstanding Research Award, National Science & Technology Commission (NSTC), Korea
2011 Minister Award for Outstanding Teachers, Ministry of Education, Science and Technology
2007 Outstanding Research Award, National Research Foundation, Korea
1999 National Research Council (NRC) Research Fellowship Award, NASA-Langley Research Center
1993 Korean Government Overseas Scholarship Award (Polymer Chemistry), Ministry of Education

Research Summary

Total Paper	**Aver. IF (5yr)**	**Citation**				**Patent**		**Tech Transfer**
>300	**>15**	**WOS**		**Google**		**Int'l**	**Domestic**	**US$ 1M**
		Citation	***h*-index**	**Citation**	***h*-index**	**>20**	**>60**	
		~29400	**75**	**~37400**	**84**			

Selected Recent Publications (As a Main Corresponding Author)

1. Bu, Y.; Ma, R.; Wang, Y.; Zhao, Y.; Li, F.; Han, G.-F.; Baek, J.-B. "Metal-based electrocatalysts for efficient hydrogen peroxide production" *Advanced Materials* **2024**, accepted.
2. Zhao, Q.; Zhao, K.; Han, G.-F.; Huang, M.; Wang, R.; Wang, Z.; Zhou, W.; Ma. Y.; Liu, J.; Wang, Z.; Xu, C.; Huang, G.; Wang, J.; Pan, F.; Baek, J.-B. "High-capacity, fast charging and long-life magnesium/black phosphorous composite negative electrode for non-aqueous magnesium batteries" *Nature Communications* **2024**, accepted
3. Li, C.; Kim, B.; Li, Z.; Thapa, R.; Zhang, Y.; Seo, J.-M.; Guan, R.; Tang, F.; Baek, J.-H.; Kim, Y. H.; Jeon, J.-P.; Park, N.; Baek, J.-B. "Direct electroplating ruthenium precursor on the surface oxidized nickel foam for efficient and stable bifunctional alkaline water electrolysis" *Advanced Materials* **2024**, accepted.
4. Jeon, J.-P; Baek, J.-B. "Engineering out-of-plane microstructure enables higher hydrogen production" *Chem Catalysis* **2024**, accepted.
5. Kim, S.-J.; Lee, G.-H.; Lee, J.-E.; Mahmood, J.; Han, G.-F.; Baekm I.; Jeon, C.; Han, M.; Jeong, H.; Yavuz, C. T.; Chae, H. G.; Baek, J.-B. "Scalable design of Ru-embedded carbon fabric using conventional carbon fiber processing for robust electrocatalysts" *Journal of the American Chemical Society* **2024**, accepted.
6. Che, *et al.* "Out-of-plane single copper site catalysts for room-temperature benzene oxidation" *Angewandte Chemie International Edition* **2024**, accepted.
7. Kim, *et al.* "Simple functionalization of a donor monomer to enhance charge transfer in conjugated porous polymers for photocatalytic hydrogen evolution" *Angewandte Chemie International Edition* **2024**, accepted.
8. Saqib, *et al.* "Triboelectric energy harvesting from highly conjugated fused aromatic ladder structure under extreme environmental conditions" *Advanced Materials* **2024**, accepted.
9. Li, *et al.* "Active site engineering accelerates water electrolysis" *Nature Synthesis* **2024**, accepted-**News and Views**.
10. Li, *et al.* "Rhodium and carbon sites with strong metal-atom-support interaction (SAMSI) for efficient bifunctional catalysis" *ACS Nano* **2023**, 17, 24282.
11. Kim, *et al.* "Hexaazatriphenylene-based two-dimensional conductive covalent organic framework with anisotropic charge transfer" *Angewandte Chemie International Edition* **2023**, 62, e202310560.
12. Li, *et al.* "Olefin-linked covalent organic frameworks with electronegative channels as cationic highways for sustainable lithium metal battery anodes" *Angewandte Chemie International Edition* **2023**, 62, e202307459.
13. Jiang, *et al.* "Direct synthesis of fluorinated carbon materials via a solid-state mechanochemical reaction between graphite and PTFE" *Advanced Functional Materials* **2023**, 33, 2304626.
14. Kim, *et al.* "Cobalt-porphyrin-based covalent organic frameworks with donor-acceptor units as photocatalysts for carbon dioxide reduction" *Angewandte Chemie International Edition* **2023**, e202307991.
15. Li, *et al.* "Directly transforming graphite into iron single atom catalyst" *Nano Energy* **2023**, 114, 108467.
16. Kim, *et al.* "Achieving volatile potassium promoted ammonia synthesis via mechanochemistry" *Nature Communications* **2023**, 14, 2319-**Nature Editors' Highlights**.
17. Li, *et al.* "Self-accommodation induced electronic metal-support interaction on ruthenium site for alkaline hydrogen evolution" *Advanced Materials* **2023**, 35, 2301369.
18. Qi, *et al*. "Tuning the coordination environment of carbon-based single-atom catalysts via doping multiple heteroatoms and their applications in electrocatalysis" *Advanced Materials*

2023, 35, 2210575
19. Li, *et al*. "Merging platinum single atom to achieve ultrahigh mass activity and low hydrogen production cost" *ACS Nano* **2023**, 17, 2923.
20. Jeon, *et al*. "Benzotrithiophene-based covalent organic framework photocatalysts with controlled conjugation of building blocks for charge stabilization" *Angewandte Chemie International Edition* **2023**, 62, e202217416.
21. Li, et al. "Tin nanoclusters confined in nitrogenated carbon for the oxygen reduction" *ACS Nano* **2022**, 16, 18830.
22. Seo, *et al.* "Conductive and ultrastable benzoxazole-based covalent organic framework/carbon hybrid as an ideal electrocatalytic platform" *Journal of the American Chemical Society* **2022**, 144, 19973.
23. Noh, *et al.* "Hydrophenazine-linked two-dimensional ladder-type crystalline fused aromatic network with high charge transport" *Chem* **2022**, 8, 1-15.
24. Im, *et al*. "Crystalline porphyrazine-linked fused aromatic networks with high proton conductivity" *Angewandte Chemie International Edition* **2022**, 61, e202203250.
25. Han, *et al.* "Abrading bulk metal into single atoms" *Nature Nanotechnology* **2022**, 17, 403-407.
26. Han, *et al.* "Extreme enhancement of carbon hydrogasification via mechanochemistry" *Angewandte Chemie International Edition* **2022**, 61, e202117851-**Hot Paper.**
27. Li, *et al.* "Engineering the orbital entanglement of platinum single atom active sites for cost-efficient hydrogen evolution reaction" *Nano Energy* **2022**, 93, 106819
28. Li, *et al.* "Nanocatalytic materials for energy-related small-molecules conversion: Active site design, identification and structure-performance relationship discovery" *Accounts of Chemical Research* **2022**, 55, 110-120.
29. Bu, *et al.* "Carbon-based electrocatalysts for efficient hydrogen peroxide production" *Advanced Materials* **2021**, 33, 2103266.
30. Li, *et al.* "Surface electronic modulation with hetero-single atoms to enhance oxygen evolution catalysis" *ACS Nano* **2021**, 15, 11891.
31. Jiang, *et al.* "Catalyst- and Solvent-Free Synthesis of a Chemically Stable Aza-Bridged Bis(phenanthroline) Macrocycle-Linked Covalent Organic Framework" *Angewandte Chemie International Edition* **2021**, 60, 17191.
32. Kim, *et al.* "Vertically standing layered fused aromatic network structure" *Cell Reports Physical Science* **2021**, 2, 100502.
33. Li, *et al.* "Promising hydrogen production from alkaline anion exchange membrane electrolyzer" *Nano Energy* **2021**, 87, 106162.
34. Li, et al. "Active site engineering in transition metal based electrocatalysts for green energy applications" *Accounts of Materials Research* **2021**, 2, 147.
35. Mahmood, *et al.* "Fused aromatic network with exceptionally high carrier mobility" *Advanced Materials* **2021**, 33, 2004707.
36. Han, *et al.* "Mechanochemistry for ammonia synthesis under mild conditions" *Nature Nanotechnology* **2021**, 16, 325-**Top-Twelve Research Achievement in 2022**.
37. Li, *et al.* "Unveiling the active M-N_3C_1 sites for oxygen reduction catalysis" *Angewandte Chemie International Edition* **2020**, 59, 23678.
38. Noh, *et al.* "Vertical two-dimensional layered fused aromatic ladder structure" *Nature Communications* **2020**, 11, 2021.
39. Han, *et al.* "Building and identifying highly active oxygen functional groups in carbon materials for oxygen reduction to hydrogen peroxide" *Nature Communications* **2020**, 11, 2209.
40. Kweon, *et al.* "Ruthenium anchored on carbon nanotube electrocatalyst for hydrogen production with enhanced Faradiac efficiency" *Nature Communications* **2020**, 11, 1278.

41. Li, *et al.* "Balancing hydrogen adsorption/desorption by orbital modulation for highly efficient hydrogen evolution" *Nature Communications* **2019**, 10, 4060.
42. Han, *et al.* "Dissociating stable nitrogen molecules under mild conditions by cyclic strain engineering" *Science Advances* **2019**, 5, eaax8275.
43. Seo, *et al.* "Conversion of imine-linked network polymer into oxazole-linked network polymer *via* post-oxidative cyclization" *Journal of the American Chemical Society* **2019**, 141, 11786-11790.
44. Li, *et al.* "Identifying the structure of Zn-N2 active sites and structural activation" *Nature Communications* **2019**, 10, 1-7.
45. Li, *et al.* "Atomically tailoring platinum catalysts" *Nature Catalysis* **2019**, 2, 477-478-News and Views.
46. Jung, *et al.* "Emerging papamagnetism in graphitic carbon sheets after forming random hole defects" *Angewandte Chemie International Edition* **2019**, 131, 11796-11801-Inside Cover Article
47. Mahmood, *et al.* "Room-temperature organic magnetism" *Chem* **2019**, 5, 1012-1030-Preview.
48. Han, et al. "Low-temperature conversion of alcohols into graphene and hydrogen with robust selectivity" *Advanced Materials* **2019**, 31, 1870401.
49. Kweon, *et al*. "Edge-functionalized graphene nanoplatelets as metal-free electrocatalysts for dye-sensitized solar cells" *Advanced Materials* **2019**, 31, 1804440.
50. Mahmood, *et al*. "Fused aromatic network structures as a platform for efficient catalysis" *Advanced Materials* **2019**, 31, 1805062.
51. Mahmood, *et al*. "Encapsulating iridium nanoparticles inside a 3D cage-like organic network as an efficient and durable catalyst for the hydrogen evolution reaction" *Advanced Materials* **2018**, 30, 1870401.
52. Li, et al. "Sublimation Strategy for the Construction of Porous Mo3P/Mo Nanobelts: A Superior Catalyst for Water Splitting" *Angewandte Chemie International Edition* **2018**, 57, 14139.
53. Li, *et al.* "Mechanochemically assisted synthesis of Ru catalyst for hydrogen evolution with performance superior to Pt in both acidic and alkaline media" *Advanced Materials* **2018**, 30, 1803676.
54. Mahmood, *et al.* "Organic ferromagnetism: Trapping radicals in glassy state of an organic network structure" *Chem* **2018**, 4, 1-**Scientist of the Month (November) 2020**.
55. Li, *et al.* "Design of Ultrathin Nitrogenated Carbon Nanosheets with Abundant Single Atomic Copper Sites: Boosting Efficient and Stable Oxygen Reduction Catalysis" *Energy & Environmental Science* **2018**, 11, 2263.
56. Yu, *et al.* "Direct Synthesis of Covalent Triazine-based Framework from Aromatic Amides" *Angewandte Chemie International Edition* **2018**, 57, 8438.
57. Mahmood, *et al.* "Robust 3D cage-like ultramicroporous network structure with high gas uptake capacities" *Angewandte Chemie International Edition* **2018**, 57, 3415.
58. Kim, *et al.* "Defect-Free Encapsulation of Zero-Valent Iron Nanoparticles in Two-Dimensional Fused Porous Organic Networks as a Durable Oxygen Reduction Electrocatalyst" *Journal of the American Chemical Society* **2018**, 140, 1737.
59. Bae, *et al.* "Forming a three-dimensional porous organic network via explosion of organic single crystals in solid-state" *Nature Communications* **2017**, 8, 1599.
60. Kim, *et al.* "Carbon-heteroatom bond formation by ultrasonic chemical reaction for energy storage system" *Advanced Materials* **2017**, 29, 1702747
61. Xu, *et al.* "Two-dimensional Frameworks C_2N and C_3N as Anodes for Lithium-Ion Batteries" *Advanced Materials* **2017**, 29, 1702007.

62. Mahmood & Li, *et al.* "An efficient and pH-universal ruthenium-based catalyst for hydrogen evolution reaction" *Nature Nanotechnology* **2017**, 12, 441-**Top-Ten Nanotechnology in 2017**.
63. Seo, *et al.* "Defect/edge-selective functionalization of carbon-based materials" *Advanced Materials* **2017**, 29, 1606327.
64. Ju, *et al.* "Edge-selenated graphene nanoplatelets as an efficient electrocatalysts for dye-sensitized solar cells" *Science Advances* **2016**, 2, e1501459.
65. Mahmood, *et al.* "Two-dimensional polyaniline from carbonized organic single crystals in solid state" *PNAS* **2016**, 113, 7414
66. Jung, *et al.* "Unusually stable triazine-based superstructure" *Angewandte Chemie International Edition* **2016**, 128, 7539.
67. Jeon, *et al.* "Antimony-doped graphene nanoplatelets" *Nature Communications* **2015**, 6, 7123-**Top-Ten Science News in 2015**.
68. Dai, *et al.* "Metal-free catalysts for oxygen reduction reaction" *Chemical Reviews* **2015**, 115, 4823.
69. Mahmood, et al. "Nitrogenated holey two-dimensional structures" *Nature Communications* **2015**, 6, 6486-**Top-Ten Research Achievement in 2016 (Minister Award)**.
70. Xu, *et al.* "Edge-selectively halogenated graphene nanoplatelets XGnPs (X = H, Cl, Br, I) for lithium-ion batteries" *Advanced Materials* **2014**, 26, 7317.
71. Ju, *et al.* "Graphene nanoplatelets doped with N at its edges as metal-free cathodes for organic dye-sensitized solar cells" *Advanced Materials* **2014**, 26, 3055.
72. Jung, *et al.* "Direct solvothermal synthesis of B/N-doped graphene" *Angewandte Chemie International Edition* **2014**, 126, 2430.
73. Jeon, *et al.* "Edge-selectively sulfurized graphene nanoplatelets as efficient metal-free electrocatalysts: the contribution from electron spin" *Advanced Materials* **2013**, 25, 6138.
74. Chang, *et al.* "Nitrogen-doped graphene nanoplatelets from simple wet-chemical reactions and their use as n-type field-effect transistors" *Journal of the American Chemical Society* **2013**, 135, 8981.
75. Jeon, *et al.* "Large-scale production of edge-selectively functionalized graphene nanoplatelets via ball-milling and their use as metal-free electrocatalysts for oxygen reduction reaction" *Journal of the American Chemical Society* **2013**, 135, 1386-1393.
76. Jeon, *et al.* "Edge-carboxylated graphene nanosheets via ball milling" *PNAS* **2012**, 109, 5588-**Technology Transfer of 1 billion KRW**.