Gun-hee Moon

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Korea Institute of Science and Technology (KIST)
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EDUCATION

Ph.D. (Feb. 2015) Chemical Engineering, Pohang University of Science and Technology (POSTECH), 77 Cheongam-Ro, Nam-Gu, Pohang, 37673, South Korea.
Thesis title: *Fabrication of graphene-based composite materials and their photo-functional applications for energy and environment* (Advisor: Prof. Wonyong Choi, Editor-in-chief of *ACS ES&T Engineering*)

M.S. (Feb. 2011) Environmental Engineering, Pohang University of Science and Technology (POSTECH), 77 Cheongam-Ro, Nam-Gu, Pohang, 37673, South Korea.
Thesis title: *Graphene and graphene-metal nanocomposites prepared through the photocatalytic reduction of graphene oxide using the polyoxometalate* (Advisor: Prof. Wonyong Choi, Editor-in-chief of *ACS ES&T Engineering*)

B.S. (Feb. 2008) Chemical Engineering, Inha University, 100 Inharo, Nam-gu, Incheon, 22212, South Korea.
(Military service in South Korea from May. 2002 to Jun. 2004)

RESEARCH EXPERIENCE

Korea Institute of Science and Technology (KIST) 11.*2020-Present*
Extreme Materials Research Center & Climate Change Research Institute
Senior researcher
5, Hwarang-ro 14-gil, Seongbuk-gu, 02792, Seoul, South Korea

University of Science and Technology (UST) 03.*2023-Present*
Division of Nano & Information Technology
Associate professor
217 Gajeong-ro, Yuseong-gu, Daejeon 34113, South Korea

Max-Planck-Institut für Kohlenforschung (MPI KOFO) 09.*2016-10.2020*
Department of heterogeneous catalysis
Postdoctoral researcher (Full-time employment)
Kaiser-Wilhelm-Platz 1, 45470, Mülheim an der Ruhr, Germany
Advisor: Dr. Harun Tüysüz

Pohang University of Science and Technology (POSTECH) 03.*2015-08.2016*
Institute of Environmental and Energy Technology (IEET)
Postdoctoral researcher (Full-time employment)
77 Cheongam-Ro, Nam-Gu, Pohang, South Korea
Advisor: Prof. Wonyong Choi

Osaka University 06.2016-07.2016
The Institute of Science and Industrial Research (SANKEN)
Visiting scholar

Mihogaoka 8-1, Ibaraki, Osaka 567-0047, Japan
Host: Prof. Tetsuro Majima (Former editor of Lanmuir)

Pacific Northwest National Laboratory (PNNL), 06.2011-05.2012
Visiting graduate student researcher
902 Battelle Boulevard, P.O. Box 999, Richland, USA
Host: Dr. Yongsoon Shin

RESEARCH BACKGROUND & INTERESTS

- **ENVIRONMENTAL REMEDIATION**
  - ✔ Photocatalytic and catalytic remediation of aquatic pollutants
  - ✔ Investigation on the decomposition mechanism of aquatic pollutants
- **ENERGY CONVERSION & STROAGE**
  - ✔ Photocatalytic and (photo)electrochemical energy conversion to (solar) fuels
  - ✔ Fundamental studies on the dynamics of photo-generated charge carriers
- **ENERGY/ENVIRONMENTAL NANO-MATERIALS**
  - ✔ Environmental-friendly and cost-effective fabrication of composite materials
  - ✔ Control of microporous/mesoporous materials with three-dimensional nano-architectures

AWARD & HONOR

1. **Emerging investigator** honored by Journal of Materials Chemistry A (Royal Society of Chemistry) (2022)
2. **Unsung hero award** by Korea Institute of Science and Technology (2022)
3. **Best presentation award** by The Korean Scientists and Engineers Association in the FRG (2017)
4. **Young scientist award** by Korean Society of Environmental Engineers (KSEE) (2015)
5. **Excellent paper presentation award** by Korean Society of Industrial and Engineering Chemistry (2014)
6. **Alternate sponsored fellowship** by Pacific Northwest National Lab. (PNNL) (2011-2012)
7. **Best paper presentation award** by Korean Society of Photoscience (2011)
8. **Outstanding graduation student award** by Inha University (2008)

LICENSE (KOREAN)

1. '**Engineer Chemical Analysis**' certified by Human Resources Development Service of Korea (2016)

RESEARCH PERFORMANCE

A. **PUBLISHED (*h*-index: 29; *i10*-index: 35; average IF: 12.382 (1st&Corresponding IF: 13.032); total citations: 3672 in Google Scholar)** (https://scholar.google.co.kr/citations?user=EbelClkAAAAJ&hl=ko)

1. T. H. Jeon, C. Park, U. Kang, **G. Moon**, W. Kim, H. Park*, W. Choi*, "Photoelectrochemical water oxidation using hematite modified with metal-incorporated graphitic carbon nitride film as a surface passivation and hole transfer overlayer", *Appl. Catal. B–Environ.* 2024, 340, 123167. (I.F. 22.5) [2024.01.01]
2. Y. E. Kim†, Y.-Y. Ahn†, M. Kim†, J. Choi, D. Min, J. Kim, **G. Moon**, J. Lee*, "Role of inorganic anions in improving the oxidizing capacity of heat-activated peroxymonosulfate: Identification of primary degradative pathways", *Chem. Eng. J.* 2023, 478, 147472. (I.F. 15.1) [2023.12.15]

3. Y. Hu, J. Du, **G. Moon***, W. Choi*, "What controls direct hole-mediated oxidation kinetics in carbon nitride-based photocatalytic system: A model study for aqueous aromatic compounds", *ACS Catal.*, 2023, 13 (18), 12269–12280. (I.F. 12.9) **(*Co-corresponding author)** [2023.09.15]
4. S. Saqlain, M. Abbas, K. Lee, **G. Moon,** Y. D. Kim*, S. H. Kim*, "Carbon functionalities incorporated visible light active CeO_2 for augmented abatement of acetaldehyde", *Chem. Eng. J.* 2023, 471, 144437. (I.F. 15.1) [2023.09.01]
5. S. Jo, H. Kim, K. E. Lee, S. Hong, K. Cho, S. H. Kim, **G. Moon***, J. Lim*, "Unraveling Janus-like behavior of copper phosphide for selective production of reactive oxygen species: Singlet oxygen versus hydroxyl radical", *Chem. Eng. J.* 2023, 470, 144389. (I.F. 15.1) **(*Co-corresponding author)** [2023.08.15]
6. T. T. Le, M. Lee, K. H. Chae, **G. Moon***, S. H. Kim*, "Control of copper element in mesoporous iron oxide photocatalysts towards UV light-assisted superfast mineralization of isopropyl alcohol with peroxydisulfate", *Chem. Eng. J.* 2023, 451, 139048. (I.F. 15.1) **(*Co-corresponding author)** **(Released to the press)** [2023.01.01]
7. T. T. Le, V. C. Hoang, W. Zhang, J. Kim, J. M. Kim, **G. Moon**, S. H. Kim*, "Mesoporous sulfur-modified metal oxide cathodes for efficient electro-Fenton systems", *Chem. Eng. J. Adv.* 2022, 12, 100371. (I.F. Pending) [2022.11.15]
8. V. Poliukhova, J.-K. Park, D. Kim, S. Khan, J. Y. Seo, S. J. Kim, **G. Moon**, K.-Y. Baek*, S. Kim*, S.-H. Cho*, "Rational design of dynamic Z-scheme heterojunction composites for photocatalytic Cr(VI) reduction and H_2 production: An experimental and computational study", *Chem. Eng. J. Adv.* 2022, 12, 100363. (I.F. Pending) [2022.11.15]
9. L. K. Dhandole, S. Kim, **G. Moon***, "Understanding (photo)electrocatalysis for the conversion of methane to valuable chemicals through partial oxidation processes", *J. Mater. Chem. A*, 2022, 10 (37), 19107-19128. (I.F. 11.9) **(Journal of Materials Chemistry A Emerging Investigators & Journal of Materials Chemistry A HOT Papers & 2023 Journal of Materials Chemistry A Lunar New Year collection)** [2022.10.07]
10. **G. Moon**, Y. Wang, S. Kim, E. Budiyanto, H. Tüysüz*, "Preparation of practical high-performance electrodes for acidic and alkaline media water electrolysis", *ChemSusChem*, 2022, 15 (3), e202102114. (I.F. 8.4) [2022.02.08]
11. C. Kim†, H. Kwak†, **G. Moon***, W. Kim*, "Biomimetic photocatalysts for the conversion of aqueous- and gas-phase nitrogen species to molecular nitrogen via denitrification and ammonia oxidation", *J. Mater. Chem. A*, 2021, 9 (35), 19179-19205. (I.F. 11.9) **(*Co-corresponding author)** [2021.09.21]
12. S. Öztürk,† **G. Moon,**† A. Spieß, S. Roitsch, H. Tüysüz*, C. Janiak*, "Highly-efficient oxygen evolution electrocatalyst derived from metal-organic-framework and ketjenblack carbon material", *ChemPlusChem*, 2021, 86 (8), 1106-1115. (I.F. 3.4) **(†Contributed equally to this work)** **(Selected as one of most downloaded articles)** [2021.08.01]
13. J. Hwang†, **G. Moon**†, B. Kim, T. Tachikawa, T. Majima, S. Hong, K. Cho, W. Kim*, W. Choi*, "Photocatalytic reduction of dioxygen leads to the generation of free OH radical on anatase not rutile", *Appl. Catal. B–Environ.*, 2021, 286, 119905. (I.F. 22.5) **(†Contributed equally to this work)** [2021.06.05]
14. E. O. Şahin, H. Tüysüz, C. K. Chan, **G. Moon**, Y. Dai, W. Schmidt, J. Lim, C. Scheu, C. Weidenthaler*, "In situ total scattering experiments of nucleation and crystallization of tantalum oxide: from highly dilute solutions via cluster formation to nanoparticles", *Nanoscale*, 2021, 13 (1), 150-162. (I.F. 6.7) [2021.01.07]
15. M. Yu, **G. Moon**, C. Weidenthaler, R. G. Castillo, S. DeBeer, H. Tüysüz*, "Dual role of silver moieties coupled with ordered mesoporous cobalt oxide towards electrocatalytic oxygen evolution reaction", *Angew. Chem. Int. Ed.*, 2020, 59 (38), 16544-16552. (I.F. 16.6) [2020.09.14]
16. S. Lee†, S. Kim†, C. Park, **G. Moon**, H. Son, J. Baeg, W. Kim*, W. Choi*, "Nafion-assisted non-covalent assembly of molecular sensitizers and catalysts for sustained photoreduction of CO_2 to CO", *ACS Sustain. Chem. Eng.*, 2020, 8 (9), 3709-3717. (I.F. 8.4) [2020.03.09]
17. T. H. Jeon†, D. Monllor–Satoca†, **G. Moon**, W. Kim, H. Kim, D. W. Bahnemann, H. Park*, W. Choi*, "Ag(I) ions working as a hole-transfer mediator in photoelectrocatalytic water oxidation on WO_3 film", *Nat. Commun.*, 2020, 11, 967. (I.F. 16.6) [2020.02.19] **(Featured in a Nature Communications Editor's Highlights)**
18. J. Lim, H. Kim, J. Park, **G. Moon,** J. Vequizo, A. Yamakata, J. Lee, W. Choi*, "How g-C_3N_4 works and is different

from TiO_2 as environmental photocatalyst: Mechanistic view", *Environ. Sci. Technol.*, 2020, 54 (1), 497-506. (I.F. 11.4) [2020.01.07]

19. D.-h. Kim†, **G. Moon†**, M. S. Koo, H.-i. Kim*, W. Choi*, "Spontaneous oxidation of arsenite on platinized TiO_2 through activating molecular oxygen under ambient aqueous condition", *Appl. Catal. B-Environ.*, 2020, 260, 118146. (I.F. 22.5) **(†Contributed equally to this work)** [2020.01.01]
20. A. Bähr, **G. Moon**, H. Tüysüz*, "Nitrogen-doped mesostructured carbon supported metallic cobalt nanoparticles for oxygen evolution reaction", *ACS Appl. Energy Mater.*, 2019, 2 (9), 6672-6680. (I.F. 6.4) [2019.09.23]
21. Z. Haider, H.-i. Cho, **G. Moon***, H. Kim*, "Minireview: Selective production of hydrogen peroxide as a clean oxidant over structurally tailored carbon nitride photocatalysts", *Catal. Today*, 2019, 335, 55-64. (I.F. 5.3) [2019.09.01] **(*Co-corresponding author)**
22. **G. Moon,** M. Yu, C. K. Chan, H. Tüysüz*, "Highly active cobalt-based electrocatalysts with facile incorporation of dopants for oxygen evolution reaction", *Angew. Chem. Int. Ed.*, 2019, 131 (11), 3529-3533. (I.F. 16.6) [2019.03.11]
23. M. Yu, **G. Moon**, E. Bill, H. Tüysüz*, "Optimization of Ni-Fe oxide electrocatalysts for oxygen evolution reaction by using hard templating as a toolbox", *ACS Appl. Energy Mater.*, 2019, 2 (2), 1199-1209. (I.F. 6.4) [2019.02.25]
24. E.-T. Yun†, **G. Moon‡**, H. Lee, T. H. Jeon, C. Lee, W. Choi, J. Lee*, "Oxidation of organic pollutants by persulfate activated with low-temperature-modified nanodiamonds: Understanding the reaction kinetics and mechanism", *Appl. Catal. B-Environ.,* 2018, 237, 432-441. (I.F. 22.5) **(†Contributed equally to this work)** [2018.12.05]
25. A. Bähr, **G. Moon**, J. Diedenhoven*, J. Kiecherer, E. Barth, H. Tüysüz*, "Reactor design and preliminary kinetic study on adsorption/desorption of CO and Cl_2 for industrial phosgene synthesis", *Chem. Ing. Tech.,* 2018, 90 (10), 1513-1519. (I.F. 1.9) **(Invited from Special issue of Carbon2Chem consortium)** [2018.10.01]
26. N. Hasan, **G. Moon**, J. Park, J. Park, J. Kim*, "Visible light-induced degradation of sulfa drugs on pure TiO_2 through ligand-to-metal charge transfer", *Sep. Purif. Technol.*, 2018, 203, 242-250. (I.F. 8.6) [2018.09.12]
27. Y. Jo, C. Kim, **G. Moon**, J. Lee*, T. An, W. Choi*, "Activation of peroxymonosulfate on visible light irradiated TiO_2 via a charge transfer complex path", *Chem. Eng. J.* 2018, 346, 249-257. (I.F. 15.1) [2018.08.15]
28. J. Park, **G. Moon**, K.-O. Shin, J. Kim*, "Oxalate-TiO_2 complex-mediated oxidation of pharmaceutical pollutants through ligand-to-metal charge transfer under visible light", *Chem. Eng. J.* 2018, 343, 689-698. (I.F. 15.1) [2018.07.01]
29. **G. Moon**, A. Bähr, H. Tüysüz*, "Structural engineering of 3D carbon materials from transition metal ion-exchanged Y zeolite templates", *Chem. Mater.*, 2018, 30 (11), 3779-3788. (I.F. 8.6) [2018.06.12]
30. S. Kim†, **G. Moon†**, H. Kim, Y. Mun, P. Zhang, J. Lee, W. Choi*, "Selective charge transfer to dioxygen on KPF_6-modified carbon nitride for photocatalytic synthesis of H_2O_2 under visible light", *J. Catal.* 2018, 357, 51-58. (I.F. 7.3) **(†Contributed equally to this work)** **(Selected as 'Featured article by the editors in January 2018 edition')** [2018.01.01]
31. **G. Moon**, S. Kim, Y. Cho, J. Lim, D. Kim, W. Choi*, "Synergistic combination of bandgap-modified carbon nitride and WO_3 for visible light-induced oxidation of arsenite accelerated by in-situ Fenton reaction", *Appl. Catal. B-Environ.* 2017, 218, 819-824. (I.F. 22.5) [2017.12.05]
32. T. Jeon, **G. Moon**, H. Park*, W. Choi*, "Ultra-efficient and durable photoelectrochemical water oxidation using elaborately designed hematite nanorod arrays", *Nano Energy* 2017, 39, 211-218. (I.F. 17.6) [2017.09.01]
33. **G. Moon,** M. Fujitsuka, S. Kim, T. Majima, X. Wang, W. Choi*, "Eco-friendly photochemical production of H_2O_2 through O_2 reduction over carbon nitride frameworks incorporated with multiple heteroelements", *ACS Catal.* 2017, 7 (4), 2886-2895. (I.F. 12.9) [2017.04.07]
34. S. Kim, **G. Moon,** G. Kim, U. Kang, H. Park, W. Choi*, "TiO_2 complexed with dopamine polymers and the visible light photocatalytic activities for water pollutants", *J. Catal.* 2017, 346, 92-100. (I.F. 7.3) [2017.02.01]
35. H. Kim, H. Kim, S. Weon, **G. Moon,** J.-H. Kim, W. Choi*, "Robust co-catalytic performance of nanodiamonds

loaded on WO_3 for the decomposition of volatile organic compounds under visible light", *ACS Catal.* 2016, 6 (12), 8350-8360. (I.F. 12.9) [2016.12.02]

36. Y. Cho, **G. Moon**, T. Kanazawa, K. Maeda, W. Choi*, "Selective dual-purpose photocatalysis for simultaneous H_2 evolution and mineralization of organic compound enabled by Cr_2O_3 barrier layer coated on $Rh/SrTiO_3$", *Chem. Commun.* 2016, 52, 9636-9639. (I.F. 4.9) **(Selected as 'Inside back cover')** [2016.08.11]
37. Y. Choi, H. Kim, **G. Moon**, S. Jo, W. Choi*, "Boosting up the low catalytic activity of silver for H_2 production on Ag/TiO_2 photocatalyst: Thiocyanate as a selective modifier", *ACS Catal.* 2016, 6 (2), 821-828. (I.F. 12.9) [2016.02.05]
38. H. Park, H. Kim, **G. Moon**, W. Choi*, "Photoinduced charge transfer processes in solar photocatalysis based on modified TiO_2", *Energy Environ. Sci.* 2016, 9 (2), 411-433. (I.F. 32.5) **[Perspective]** **(Selected as 'Inside back cover')** [2016.02.01]
39. J. Kim, **G. Moon**, S. Kim, J. Kim*, "Photocatalytic oxidation mechanism of arsenite on tungsten trioxide under visible light", *J. Photochem. Photobiol. A: Chem.* 2015, 311, 35-40. (I.F. 4.3) [2015.10.01]
40. W. Kim, T. Tachikawa, **G. Moon**, T. Majima, W. Choi*, "Molecular-level understanding of the photocatalytic activity difference between anatase and rutile nanoparticles", *Angew. Chem. Int. Ed.* 2014, 53 (51), 14036-14041. (I.F. 16.6) [2014.12.15]
41. **G. Moon**, W. Kim, A. D. Bokare, N. Sung, W. Choi*, "Solar production of H_2O_2 on reduced graphene oxide-TiO_2 hybrid photocatalysts consisting of earth abundant elements only", *Energy Environ. Sci.* 2014, 7 (12), 4023-4028. (I.F. 32.5) [2014.12.01]
42. **G. Moon**[‡], D.-h. Kim[†], H.-i. Kim, A. D. Bokare, W. Choi*, "Platinum-like behavior of reduced graphene oxide as a cocatalyst on TiO_2 for the efficient photocatalytic oxidation of arsenite", *Environ. Sci. Technol. Lett.* 2014, 1 (2), 185-190. (I.F. 10.9) **([†]Contributed equally to this work)** **(Selected as 'Top 10 most read articles for January-June 2014')** [2014.02.11]
43. **G. Moon**, Y. Shin*, D. Choi, B. W. Arey, G. J. Exarhos, C. Wang, W. Choi*, J. Liu*, "Catalytic templating approaches for three-dimensional hollow carbon/graphene oxide nano-architectures", *Nanoscale* 2013, 5 (14), 6291-6296. (I.F. 6.7) [2013.07.21]
44. **G. Moon**, Y. Shin*, B. W. Arey, C. Wang, G. J. Exarhos, W. Choi*, J. Liu, "Carbon dioxide-assisted fabrication of highly uniform submicron-sized colloidal carbon spheres via hydrothermal carbonization using soft drink", *Colloid Polym. Sci.* 2012, 290 (15), 1567-1573. (I.F. 2.4) [2012.10.01]
45. **G. Moon**, H.-I. Kim, Y. Shin, W. Choi*, "Chemical-free growth of metal nanoparticles on graphene oxide sheets under visible light irradiation", *RSC Adv.* 2012, 2 (6), 2205-2207. (I.F. 3.9) [2012.03.14]
46. J.-W. Jang, S. Choi, **G. Moon**, K. Ihm, J. Y. Kim, D. H. Youn, S. Lee, Y. H. Lee, W. Choi, K.-H. Lee, J. S. Lee*, "Photocatalytic synthesis of pure and water-dispersible graphene monosheets", *Chem. Eur. J.* 2012, 18 (10), 2762-2767. (I.F. 4.3) [2012.03.05]
47. H. Kim, **G. Moon**, D. Monllor-Satoca, Y. Park, W. Choi*, "Solar photoconversion using graphene/TiO_2 composites: Nano-graphene shell on TiO_2 core versus TiO_2 Nanoparticles on graphene sheet", *J. Phys. Chem. C* 2012, 116 (1), 1535-1543. (I.F. 3.7) [2012.01.12]
48. **G. Moon**, Y. Park, W. Kim, W. Choi*, "Photochemical loading of metal nanoparticles on reduced graphene oxide sheets using phosphotungstate", *Carbon* 2011, 49 (11), 3454-3462. (I.F. 10.9) [2011.09.01]

B. BOOK CHAPTER

1. G. Kim, Y. Park, **G. Moon**, W. Choi. "Chapter 5: Photoexcitation in pure and modified semiconductor photocatalysts" In: Photocatalysis: Fundamentals and Perspectives, Eds. J. Schneider, D. Bahnemann, J. Ye, G. L. Puma, D. D. Dionysiou. 2016, 110-128. (RSC Energy and Environment Series)

C. PATENT (DOMESTIC)

1. S.H. Kim, **G. Moon**, J. Kim, "Organic compound degradation catalyst composition using iron oxide, preparation method thereof, and organic compound degradation method using same", Application No.:

1020210152234 (2021.11.08), Registration No.: 1025114100000 (2023.03.14).

2. W. Choi, **G. Moon**, “Photocatalyst, method for preparing same and method for producing hydrogen peroxide using same”, Application No.: 10-2016-0012381 (2016.02.01), Registration No.: 10-1743945 (2017.05.31).
3. W. Choi, **G. Moon**, “Method for preparing reduced graphene oxide-titanium dioxide photocatalyst composite and method for producing hydrogen peroxide as a solar fuel using the same”, Application No.: 10-2014-0120305 (2014.09.11), Registration No.: 10-1563346 (2015.10.20).

D. PATENT (INTERNATIONAL)

1. S.H. Kim, **G. Moon**, J. Kim, “Catalyst composition for degradation of organic compound using iron oxide, preparation method thereof, and method for degradation of organic compound using the same”, Application No.: US17730877 (2022.04.27); EP22170720.1 (2022.04.29).
2. H. Tüysüz, **G. Moon**, “Process for the preparation of an electrode for electrolytic application”, Application No.: EP21161582.8 (2021.03.09).

E. PUBLICATION IN DOMESTIC JOURNALS

1. **G. Moon**, “Graphene-based photocatalytic systems for environmental remediation”, *Photoscience World* 2015, 53, 10-16. (Invited)
2. **G. Moon**, “Design of photocatalytic materials for hydrogen peroxide production”, *Ceramist*, 2022, 25 (2), 172-183. (Invited)