Meet the Editorial Board

Professor Liang-Nian He received his Ph.D. degree from the Nankai University in 1996. Then, he worked as a Chinese postdoctoral fellow at the Wuhan University. He had worked as a Postdoctoral Research Associate at the National Institute of Advanced Science and Technology, Japan from 1999 to 2003 before joining Nankai University in April 2003.

Professor He has authored and co-authored over 140 peer reviewed journals articles, Angew Chem Int Ed., Chem Commun, Energy Environ Sci, J Org Chem, J Catal, Green Chem, Adv Synth Catal, ChemSusChem, and held 8 patents. He has also edited 10 books and chapters, and has delivered more than 40 keynotes, invited talks at international and national conferences as well as universities and research institutes worldwide.

Now Professor He is a Professor of Chemistry at the State key Laboratory of Elemento-Organic Chemistry, Nankai University, a Fellow of the Royal Society of Chemistry (FRSC), a Series Editor of “Green Chemistry and Sustainable Technology” (Springer Publisher), and a member of Ionic Liquids Professional Committee and Chinese Fine Chemical Committee. He also serves as an editorial board member for 8 international journals, a referee for leading journals in the field of chemistry, green chemistry, catalysis and environment science.

Current research involves CO2 chemistry, green synthetic chemistry, synthesis and application of task-specific ionic liquid, catalysis in green solvent such as ionic liquid, PEG and water, and biomass conversion, particularly chemical transformation of CO2 into fuels, chemicals and materials as well as CO2 capture and utilization, Green technology related to desulfurization.

SUMMARY OF MAJOR RESEARCH CONTRIBUTIONS

Green Chemistry could be an essential tool and general principle in our campaign to protect our environment and could preserve natural resources against further depletion to satisfy the world’s expanding population and subsequent energy demand. In this context, carbon dioxide chemistry has attracted much attention due to global warming associated with carbon accumulation. Chemical utilization of CO2 as feedstock or promoter or reaction media for producing valuable chemicals, materials and fuels is attractive as an integral part of carbon cycle. In particular, establishing large-scale production using CO2 in industry would be a fascinating dream for synthetic chemists. However, the kinetic and thermodynamic stability of CO2 molecule presents great obstacles in developing efficient chemical processes by utilizing CO2 as a typical renewable feedstock. However, the reactions involving CO2 are carried out at high pressure, which may not be economically suitable and also pose safety concerns. The crucial challenge is to develop efficacious catalysts that are capable of activating CO2 under low pressure (preferably at 1 atm), and thus incorporating CO2 into organic molecules catalytically. In this aspect, efforts to convert CO2 to useful chemicals will inevitably rely on its activation through molecular catalysts, particularly transition-metal catalysts. To circumvent energy consumption problem in CO2 capture and storage/sequestration, we proposed CO2 capture and subsequent utilization strategy, which is based on the idea of capturing CO2, simultaneously leading to its activation, and facilely performing the reaction under mild conditions.

We have created innovative technologies for CO2 utilization with efficient use of renewable carbon-neutral energy source; and developed greener processes on a large scale without negative impact on the environment through designing effective catalysts based on understanding the reaction mechanism under high pressure at molecular level.

We have also demonstrated that versatile uses of CO2 in organic synthesis, with the main focus on utilization of CO2 as a building block for the synthesis of industrial useful compounds such as cyclic carbonates, oxazolidinones, lactones, quinazolines, etc. through C-C, C-O, C-N bond formation; including potential use of dense CO2, in combination with green solvent like ionic liquid, polyethylene glycol (PEG) as an alternative solvent and otherwise specific roles in organic synthesis. In this particular, we have developed efficient homogeneous and heterogeneous catalytic processes for the use of CO2 in organic synthesis as replacement of phosgene and carbon monoxide for the synthesis of value-added compounds such as cyclic carbonates, oxazolidinones, ureas, isocyanates, and polyesters, affording greener pathways for future chemical processes.

With the increasing demands for safer and cleaner chemical synthesis, the hazardous route has to be improved or essentially replaced by eco-friendly technologies. We have developed effective processes for organic synthesis using CO2 as an environmentally friendly and economically feasible carboxylating reagent. Furthermore, we have found reversible in situ acidic CO2/H2O and CO2-ethanol catalytic system for selective transformation of a series of alcohols to the respective carbonyl compounds, and regioselective oxybromination of aromatic ethers. Notably, the system avoids any conventional acid and can eliminate unwanted byproducts, facilitate reaction, ease separation of the catalyst and product, and also can provide a safe environment for oxidation involving oxygen gas.

We have proposed practically utilisable free-radical chemistry of PEG induced by molecule oxygen in dense CO2, and successfully applied to important and fundamental organic reactions such as oxidation reaction with enormous synthetic potentials. This is an interesting and rather creative, unusual use for PEG, offering an environmentally friendly, metal-free, cost-efficient and viable access to a diverse set of synthetic useful transformations without any additional free radical initiator nor a catalyst.
RECENT PUBLICATIONS

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3. Zhen-Zhen Yang, Liang-Nian He*, Ya-Nan Zhao, Bin Li and Bing Yu, CO\textsubscript{2} capture and activation by superbase/polyethylene glycol and its subsequent conversion. Energy Environ. Sci., 2011, 4, 3971-3975.

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5. Shuai Zhang, Yu-Nong Li, Ya-Wei Zhang, Liang-Nian He*, Bing Yu, Qing-Wen Song, Xian-Dong Lang, Equimolar Carbon Absorption by Potassium Phthalimide and In Situ Catalytic Conversion Under Mild Conditions. ChemSusChem, 2014, 7, 1484-1489.

6. Zhen-Zhen Yang, Qing-Wen Song, Liang-Nian He*. Capture and Utilization of Carbon Dioxide with Polyethylene Glycol (ISBN 978-3-642-31267-0, ISSN 2212-9898), in Springer Briefs in Green Chemistry for Sustainability, Springer: Dordrecht Heidelberg, 2012.

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9. Zhen-Zhen Yang, Liang-Nian He*, Ya-Nan Zhao and Bing Yu, Highly Efficient SO\textsubscript{2} Absorption and Its Subsequent Utilization by Weak Base/Polyethylene Glycol Binary System. Environ. Sci. Technol., 2013, 47, 1598-1605.

10. An-Hua Liu, Yu-Nong Li, and Liang-Nian He*, Organic synthesis using carbon dioxide as phosgene-free carbonyl reagent. Pure Appl. Chem. 2012, 84, 518-602.

REFERENCES

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Current research involves CO\textsubscript{2} chemistry, green synthetic chemistry, catalysis in green solvent and biomass conversion (castor-based energy), particularly catalytic transformation of CO\textsubscript{2} into fuels and value-added chemicals as well as CO\textsubscript{2} capture and utilization. Great efforts have been directed towards constructing C-C, C-O and C-N bond on the basis of CO\textsubscript{2} activation through molecular catalysis owing to its kinetic and thermodynamic stability. The aim of his research is to demonstrate the versatile use of CO\textsubscript{2} in organic synthesis, with the main focus on utilization of CO\textsubscript{2} as a building block for synthesis of industrial useful compounds and fuel additives such as cyclic carbonates, oxazolidinones, lactones, quinazolines, etc. CO\textsubscript{2} capture by using efficient chemical absorbents and the potential use of dense CO\textsubscript{2} or green solvent like ionic liquid, polyethylene glycol as an alternative solvent and otherwise specific roles in organic synthesis are also involved.

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