

## Jianrong (Steve) Zhou

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### Academic qualification

2000-2005 Ph.D., Massachusetts Institute of Technology. Supervisor: Gregory Fu  
1998-2000 M.Sc., National University of Singapore. Supervisor: Teck-Peng Loh  
1994-1998 B.Sc. with first-class honors, National University of Singapore

### Appointment and work experience

2005-2008 Postdoctoral researcher, Yale University & University of Illinois at Urbana. Supervisor: John Hartwig  
2008 Nanyang assistant professor, Nanyang Technological University  
2008-2013 Singapore National Research Foundation Fellow  
2015 since International advisory board, *Organic Process Research & Development*

## A. TEACHING

### [1] Development of teaching materials

- CM4032 Current topics in synthetic organic chemistry (topic: radical chemistry in organic synthesis)
- CM3021 Organometallic chemistry (core module)
- CM2031 Organic chemistry and bioorganic chemistry (core module)
- CBC723 Graduate organic chemistry

### [2] Service as external examiner: PhD thesis examiner at NTU and NUS

### [3] Other Information

- Supervised 11 PhD students and 5 graduated
- Supervised more than 10 postdoc researchers (8 assumed professor positions in China)
- Mentored more than 10 high school and JC students research
- Average teaching score ~4 in last 3 academic years 2013-15 (including CM2031 and CM3021, 2 core modules with >200 students)

## B. RESEARCH

### [1] Awards

2008 Singapore National Research Foundation fellowship  
2011 Asian Core Program Lectureship Award, Taiwan  
2012 Thieme Chemistry Journal Award  
2012 Asian Core Program Lectureship Award, Malaysia  
2013 Asian Core Program Lectureship Award, Taiwan  
2013 GSK Green and Sustainable Manufacturing Award, Singapore  
2014 New Phase Asian Core Program Lectureship Award, Japan  
2015 SPMS Young Researcher Award, Nanyang Technological University

### [2] Citations (based on ISI Web of Science, Feb 2 2016)

- Sum of times cited: 1466 (1426 without self-citation)
- 42 publications (+ 2 published recently). Average citation per paper: 35
- H-index: 21
- Author Profile in *Angewandte Chemie International Edition* 2016, 55 (15), 4636. DOI: 10.1002/anie.201510761

### [2] Selected invited lectureships and invited talks in conferences (including conference papers)

1. Asian Core Program lectureships in universities in China (SIOC, Nanjing, Zhejiang, Beijing, and Tsinghua 2014), Japan (Osaka, Kyoto, Tokyo, Tokyo Tech 2013), Taiwan (National Tsinghua, National Sun Yat-Sen, 2012) and Malaysia (University of Malaya, 2011)
2. 5<sup>th</sup> International Conference on Cutting-Edging Organic Chemistry in Asia. **Taiwan**, December 2010. Lecture "Copper-catalyzed [4+1] cycloaddition of 1,3-dienes and nitrene precursors"
3. 240th ACS National Meeting. August 2010. **Boston**, USA. Oral communication "Copper-catalyzed [4+1] cycloaddition of 1,3-dienes and nitrene precursors"
4. 6<sup>th</sup> International Conference on Cutting-Edging Organic Chemistry in Asia. **Hong Kong**, December 2011. Lecture "Selective palladium-catalyzed reactions"
5. 7<sup>th</sup> International Conference on Cutting-Edging Organic Chemistry in Asia. December 2012, **Singapore**. Lecture "Weak hydrogen bonding as stereo-controlling element in asymmetric palladium catalysis"
6. 3rd Molecular Materials Meeting in Biopolis. Jan 2013. **Singapore**. Invited talk "Organic synthesis using new palladium-catalyzed reactions"
7. 15th Asian Chemical Conference. August 2013, **Singapore**. Oral presentation "Understanding the origin of stereoselectivity in asymmetric palladium catalysis"
8. 13th Tateshina Conference on Organic Chemistry. **Nagano**, Japan. November 8-10, 2013. Title: New selectivity in Heck reaction
9. 8<sup>th</sup> International Conference on Cutting-Edging Organic Chemistry in Asia. Nov 2013. **Osaka**, Japan. Title "Palladium-Catalyzed Heck Reaction of Alkyl Halides"
10. Challenges in Organic Chemistry ISACS 14 organized by Royal Society of Chemistry, UK. August 2014. **Shanghai**, China. Invited lecture "Asymmetric olefin transfer hydrogenation using first-row metal catalysts"
11. Chiral China 2014 Symposium organized by Chinese Chemical Society. **Hefei**, China, September 2014. Invited lecture: "Asymmetric transfer hydrogenation of olefins using nickel catalysts"
12. Singapore International Chemical Conference SICC-8 organized by Singapore National Institute of Chemistry. **Singapore**, December 2014. Invited lecture "Nickel-catalyzed asymmetric transfer hydrogenation"
13. 13<sup>th</sup> International Symposium for Chinese Organic Chemists ISCO-13. **Xiamen**, China, December 2014. Invited lecture "Nickel-catalyzed asymmetric transfer hydrogenation"
14. 9<sup>th</sup> International Conference on Cutting-Edging Organic Chemistry in Asia. December 2014. **Kuala Lumpur**, Malaysia. "Nickel-catalyzed symmetric transfer hydrogenation"
15. 11<sup>th</sup> SINO-US Chinese Chemistry and Chemical Biology Professors Conference. **Soochow**, China, June 21-23 2015. Invited lecture "Regioselective alkylation of heterocycles and carbocycles using palladium catalysts"
16. 16<sup>th</sup> Tetrahedron Symposium. 16–19 June 2015. **Berlin**, Germany. Title: Nickel-catalyzed asymmetric transfer hydrogenation
17. Organometallics directed towards organic synthesis OMCOS 18. **Sitges-Barcelona**, Spain, June 28-July 2, 2015. Invited talk: "Nickel-catalyzed asymmetric hydrogenation reactions using formic acid"
18. 7th National Conference of Organic Chemistry organized by Chinese Chemical Society. **Changchun**, China, July 29-31 2015. Invited lecture: "Regioselective radical alkylation of heterocycles and carbocycles using transition metal catalysts"
19. Golden Jubilee Chemistry Conference organized by Singapore National Institute of Chemistry. **Singapore**, August 2015. Golden Jubilee lecture: "Nickel-catalyzed asymmetric transfer hydrogenation"

20. 27th International Conference on Organometallic Chemistry ICOMC 2016. July 17-22, 2016. **Melbourne**, Australia. Invited talk: "Exploration of palladium catalysis: discovery and surprise"
21. 19<sup>th</sup> National Conference of Organometallic Chemistry organized by Chinese Chemical Society. October 28-31, 2016. **Hangzhou**, China. Invited lecture "Classical and weak hydrogen bonding in asymmetric palladium catalysis"
22. International Symposium on Catalysis and Fine Chemical CFC 2016. November 17-22 2016. **Taipei**. Invited lecture "Hydrogen bonding in asymmetric palladium catalysis: the strong and the weak"
23. 253rd ACS National Meeting in **San Francisco**, USA. April 2-6, 2017. Invited talk: "Nickel-Catalyzed Asymmetric Transfer Hydrogenation of Unsaturated Bonds" in 2017 ACS Sustainable Chemistry & Engineering Lectureship Awards: Symposium in honor of Helen Sneddon
24. 253rd ACS National Meeting in **San Francisco**, USA. April 2-6, 2017. Title "Palladium-Catalyzed Processes Involving Olefin Insertion, Enolate Coupling and Radical Alkylation" in Metal-Mediated Reactions & Syntheses Symposium
25. 253rd ACS National Meeting in **San Francisco**, USA. April 2-6, 2017. Title "Alkylation, Arylation and Cyclopropylation of Common Heterocycles via Palladium Catalysis" in Heterocycles & Aromatics Symposium
26. 8th Pacific Symposium on Radical Chemistry, **Brisbane**, Australia. July 18-22, 2017. Invited talk
27. 2017 Gordon Research Conference: Organic Reactions & Processes. July 23-28, 2017. Stonehill College, Easton, **Massachusetts**, USA. Invited talk

## C. PUBLICATIONS

[1] [Journal papers: publications at NTU](#)

52. Copper-catalyzed Asymmetric Addition of Organoborons to Aldimines via an Elementary 1,4-Insertion  
Chunlin Wu, Adhitya Mangala Putra, Hajime Hirao, Jianrong (Steve) Zhou  
*J. Am. Chem. Soc.* submitted.
51. Nickel-Catalyzed Direct Olefination of Ketones with Organoboron Reagents under Neutral Conditions.  
Chuanhu Lei, Yip Yong Jie, Jianrong (Steve) Zhou  
*J. Am. Chem. Soc.* submitted.
50. Palladium-Catalyzed Arylation of Ketones and Acetonitrile with ortho-Alkylation of Aryl Rings: de novo Synthesis of Tetralines and Benzocycloheptenes. Chuanhu Lei, Jiajia Cao, Jianrong (Steve) Zhou.  
*Org. Lett.* **2016**, online. DOI: 10.1021/acs.orglett.6b03130
49. Palladium-Catalyzed Asymmetric  $\alpha$ -Arylation of AlkylNitriles. Zhiwei Jiao, Kwok Wei Chee, Jianrong (Steve) Zhou  
*J. Am. Chem. Soc.* **2016**, *138*, under revision. ja-2016-09580e
48. Palladium-Catalyzed Enantioselective  $\alpha$ -Arylation of  $\alpha$ -Fluoroketones. Zhiwei Jiao, Jason Beiger, Yushu Jin, Shaozhong Ge, Jianrong (Steve) Zhou,\* John F. Hartwig\*  
*J. Am. Chem. Soc.* **2016**, *138*, online. DOI: 10.1021/jacs.6b09580
47. *N,N*-Dimethylformamide as Hydride Source in Nickel-Catalyzed Asymmetric Hydrogenation of  $\alpha,\beta$ -Unsaturated Esters. Siyu Guo, Jianrong (Steve) Zhou *Org. Lett.* **2016**, *18*, 5344. DOI: 10.1021/acs.orglett.6b02662  
One of the most read Org Lett papers of the month.
46. Nickel-Catalyzed Enantioselective Reductive Amination of Ketones with Both Arylamines and Benzhydrazide.  
Peng Yang, Li Hui Lim, Pratanphorn Chuanprasit, Hajime Hirao, Jianrong (Steve) Zhou

- Angew. Chem. Int. Ed.* **2016**, *55*, 12083. DOI: 10.1002/anie.201606821
44. Palladium-Catalyzed Alkynylation and Concomitant *ortho*-Alkylation of Aryl Iodides. Chuanhu Lei, Xiaojia Jin, Jianrong (Steve) Zhou *ACS Catal.* **2016**, *6*, 1635. DOI: 10.1021/acscatal.6b00169
43. Asymmetric Conjugate Addition of Organoboron Reagents to Common Enones Using Copper Catalysts. Chunlin Wu, Guizhou Yue, Christian Duc-Trieu Nielson, Kai Xu, Hajime Hirao, Jianrong (Steve) Zhou *J. Am. Chem. Soc.* **2016**, *138*, 742. DOI: 10.1021/jacs.5b11441  
One of the most read JACS papers of the month.
42. Palladium-Catalyzed Heteroarylation and Concomitant *ortho*-Alkylation of Aryl Iodides. Chuanhu Lei, Xiaojia Jin, Jianrong (Steve) Zhou *Angew. Chem. Int. Ed.* **2015**, *54*, 13397. DOI: 10.1002/anie.201507128
41. Palladium-Catalyzed Direct Cyclopropylation of Heterocycles. Xiaojin Wu, Chuanhu Lei, Guizhou Yue, Jianrong (Steve) Zhou *Angew. Chem. Int. Ed.* **2015**, *54*, 9601. DOI: 10.1002/anie.201504735.  
Highlighted in Synform 2015, *12*, A175.
40. Nickel-Catalyzed Asymmetric Transfer Hydrogenation of Conjugated Olefins. Siyu Guo, Peng Yang, Jianrong (Steve) Zhou *Chem. Commun.* **2015**, *51*, 12115. DOI: 10.1039/C5CC01632K
39. Palladium-Catalyzed Asymmetric Reductive Heck Reaction of Aryl Halides. Guizhou Yue, Kaining Lei, Hajime Hirao, Jianrong (Steve) Zhou *Angew. Chem. Int. Ed.* **2015**, *54*, 6531. DOI: 10.1002/anie.201501712.  
One of the most accessed *Angew Chem* papers of the month
38. A Challenging Heck reaction of Maleimides. Li Hui Lim, Jianrong (Steve) Zhou *Org. Chem. Front.* **2015**, *2*, 775. DOI: 10.1039/C5QO00015G
37. Nickel-Catalyzed Asymmetric Transfer Hydrogenation of Hydrazones and Other Ketimines. Haiyan Xu, Peng Yang, Pratanphorn Chuanpravit, Hajime Hirao, Jianrong (Steve) Zhou *Angew. Chem. Int. Ed.* **2015**, *54*, 5112. DOI: 10.1002/anie.201501018
36. A General Palladium-Catalyzed Method for Alkylation of Heteroarenes Using Secondary and Tertiary Alkyl Halides. Xiaojin Wu, Jessica Wei Ting See, Kai Xu, Hajime Hirao, Julien Roger, Jean-Cyrille Hierso, Jianrong (Steve) Zhou *Angew. Chem. Int. Ed.* **2014**, *53*, 13573. DOI: 10.1002/anie.201408355.  
One of most accessed *Angew Chem* papers of the month
35. Nickel-Catalyzed Asymmetric Transfer Hydrogenation of Olefins for the Synthesis of  $\alpha$ - and  $\beta$ -Amino Acids. Peng Yang, Haiyan Xu, Jianrong (Steve) Zhou *Angew. Chem. Int. Ed.* **2014**, *53*, 12210. DOI: 10.1002/anie.201407744
34. Asymmetric Intermolecular Heck Reaction of Aryl Halides. Chunlin Wu, Jianrong (Steve) Zhou *J. Am. Chem. Soc.* **2014**, *136*, 650. DOI: 10.1021/ja412277z.  
One of most read JACS papers of the month. Highlighted by Org Chem Portal in 2015
33. General Suzuki coupling of heteroaryl bromides by using tri-*tert*-butylphosphine as a supporting ligand. Yinjun Zou, Guizhou Yue, Jianwei Xu, Jianrong (Steve) Zhou. *Eur. J. Org. Chem.* **2014**, 5901.
32. Palladium-catalyzed intermolecular Heck reaction of alkyl halides. Yinjun Zou, Jianrong (Steve) Zhou *Chem. Commun.* **2014**, 49, 9425.
31. A General Method for Asymmetric Arylation and Vinylation of Silyl Ketene Acetals. Junfeng Yang, Jianrong (Steve) Zhou *Org. Chem. Front.* **2014**, *1*, 365.
30. Weak Arene C–H $\cdots$ O Hydrogen Bonding as Stereocontrolling Tool in Palladium-Catalyzed Arylation and Vinylation of Ketones. Zhiyan Huang, Li Hui Lim, Zuliang Chen, Yongxin Li, Feng Zhou, Haibin Su, Jianrong (Steve) Zhou *Angew. Chem. Int. Ed.* **2013**, *52*, 4906 (hot paper).  
Highlighted by Org Chem Portal in 2013.

29. Arene CH/O Hydrogen Bonding in Palladium-Catalyzed Arylation and Vinylation of Lactones. Zhiyan Huang, Zuliang Chen, Li Hui Lim, Gia Chuong Phan Quang, Hajime Hirao, Jianrong (Steve) Zhou *Angew. Chem. Int. Ed.* **2013**, 52, 5807.
28. Palladium-Catalyzed Asymmetric Intermolecular Cyclization. Jian Hu, Hajime Hirao, Yongxin Li, Jianrong (Steve) Zhou *Angew. Chem. Int. Ed.* **2013**, 52, 8676.
27. Highly active catalysts of bisphosphine oxides for asymmetric Heck reaction. Jian Hu, Yunpeng Lu, Yongxin Li, Jianrong (Steve) Zhou *Chem. Commun.* **2013**, 49, 9425.  
Highlighted in "Breaking News on the Enantioselective Intermolecular Heck Reaction" by M. Oestreich in *Angew. Chem. Int. Ed.* 2014, 53, 2282.
26. An efficient method for the Heck-Catellani reaction of aryl halides. Xiaojin Wu, Jianrong (Steve) Zhou *Chem. Commun.* **2013**, 49, 11035.
25. Selective Arylation at the Vinylic Site of Cyclic Olefins. Xiaojin Wu, Jianrong (Steve) Zhou *Chem. Commun.* **2013**, 49, 4794.
24. Regioselective Heck reaction of aliphatic olefins and aryl halides. Liena Qin, Hajime Hirao, Jianrong (Steve) Zhou *Chem. Commun.* **2013**, 10236.
23. Desymmetrization of Cyclic Olefins via Asymmetric Heck Reaction and Hydroarylation. Sijia Liu, Jianrong (Steve) Zhou *Chem. Commun.* **2013**, 11758. Highlighted by Org Chem Portal in 2014.
22. Achieving Vinylic Selectivity in Mizoroki-Heck Reaction of Cyclic Olefins. Xiaojin Wu, Yunpeng Lu, Hajime Hirao, Jianrong (Steve) Zhou *Chem.-Eur. J.* **2013**, 19, 6014.
21. Selective arylation and vinylation at  $\alpha$ -Selectivity of vinylarenes. Yinjun Zou, Liena Qin, Xinfeng Ren, Yunpeng Lu, Yongxin Li, Jianrong (Steve) Zhou *Chem.-Eur. J.* **2013**, 19, 3504.
20. Asymmetric Intermolecular Mizoroki-Heck Reaction of Benzylic Electrophiles. Zhigang Yang, Jianrong (Steve) Zhou *J. Am. Chem. Soc.* **2012**, 134, 11833.  
One of most read JACS papers of the month. Highlighted by Synfacts in 2012 and Org Chem Portal in 2013.
19. Intermolecular Mizoroki-Heck Reaction of Aliphatic Olefins with High Selectivity for Substitution at the Internal Position. Liena Qin, Xinfeng Ren, Yongxin Li, Jianrong (Steve) Zhou *Angew. Chem. Int. Ed.* **2012**, 51, 5915 (Hot paper).  
Highlighted by Org Chem Portal in 2012.
18. Room-Temperature Suzuki-Miyaura Coupling of Heteroaryl Chlorides and Tosylates. Junfeng Yang, Sijia Liu, Jianfeng Zheng, Jianrong (Steve) Zhou *Eur. J. Org. Chem.* **2012**, 31, 6248. The 4<sup>th</sup> most accessed articles since the inception of the journal.
17. Recent Developments in Asymmetric Coupling of Enolates (invited review). Jianrong (Steve) Zhou *Synlett* **2012**, 1
16. An Enantioselective Intermolecular  $\alpha$ -Arylation of Ester Enolates to Form Tertiary Stereocenters. Zhiyan Huang, Zheng Liu, Jianrong (Steve) Zhou *J. Am. Chem. Soc.* **2011**, 133, 15882.  
One of most read JACS papers of the month. Highlighted by Synfacts in 2011 and Org Chem Portal in 2012.
15. Nickel-Thiolate Complex Catalyst Assembled in One Step in Water for Solar H<sub>2</sub> Production. Wei Zhang, Jindui Hong, Jianwei Zheng, Zhiyan Huang, Jianrong (Steve) Zhou, Rong Xu\* *J. Am. Chem. Soc.* **2011**, 133, 20680
14. An efficient, overall [4+1] cycloaddition of 1,3-dienes and nitrene precursors. Qiong Wu, Jian Hu, Xinfeng Ren, Jianrong (Steve) Zhou *Chem.-Eur. J.* **2011**, 17, 11553. DOI: 10.1002/chem.201101630

13. Iridium-Catalyzed Intermolecular Hydroamination of Unactivated Alkenes with Indoles. Christo S. Sevov, Jianrong (Steve) Zhou, John F. Hartwig *J. Am. Chem. Soc.* **2014**, *136*, 3200. One of the most read JACS papers of the month.
12. Iridium-Catalyzed Intermolecular Hydroamination of Unactivated Aliphatic Alkenes with Amides and Sulfonamides. Christo S. Sevov, Jianrong (Steve) Zhou, John F. Hartwig *J. Am. Chem. Soc.* **2012**, *134*, 11960. Highlighted by Synfacts in 2012.
11. N-H Activation of Hydrazines by Iridium(I). Double N-H Activation to Form Iridium Aminonitrene Complexes. Zheng Huang, Jianrong (Steve) Zhou, John F. Hartwig *J. Am. Chem. Soc.* **2010**, *132*, 11458.
10. Iridium-Catalyzed H/D Exchange at Vinyl Groups without Olefin Isomerization. Jianrong (Steve) Zhou, John F. Hartwig *Angew. Chem. Int. Ed.* **2008**, *47*, 5783.
9. Intermolecular, Catalytic Asymmetric Hydroamination of Bicyclic Alkenes and Dienes in High Yield and Enantioselectivity. Jianrong (Steve) Zhou, John F. Hartwig *J. Am. Chem. Soc.* **2008**, *130*, 12220.
8. Suzuki Cross-Couplings of Unactivated Secondary Alkyl Halides. Jianrong (Steve) Zhou, Gregory C. Fu *J. Am. Chem. Soc.* **2004**, *126*, 1340. One of the most read JACS papers of the year.
7. Cross-Couplings of Unactivated Secondary Alkyl Halides: Room-Temperature Nickel-Catalyzed Negishi Reactions of Alkyl Bromides and Iodides. Jianrong (Steve) Zhou, Gregory C. Fu *J. Am. Chem. Soc.* **2003**, *125*, 14726. One of the most read JACS papers of the year.
6. Palladium-Catalyzed Negishi Cross-Coupling Reactions of Unactivated Alkyl Iodides, Bromides, Chlorides, and Tosylates. Jianrong (Steve) Zhou, Gregory C. Fu *J. Am. Chem. Soc.* **2003**, *125*, 12527. One of the most read JACS papers of the year.
5. A catalytic enantioselective allylation reaction of aldehydes in an aqueous medium. Teck-Peng Loh, Jianrong Zhou. *Tetrahedron Lett.* **2000**, *41*, 5261.
4. A novel reductive aminocyclization for the syntheses of chiral pyrrolidines: stereoselective syntheses of (S)-nornicotine and 2-(2-pyrrolidyl)-pyridines. Teck-Peng Loh, Jianrong Zhou, Xuruan Li, Keng Yeow Sim. *Tetrahedron Lett.* **1999**, *40*, 7847.
3. A Highly Enantioselective Indium-Mediated Allylation Reaction of Aldehydes. Teck-Peng Loh, Jianrong Zhou, Zheng Ying. *Org. Lett.* **1999**, *1*, 1855
2. An Enantioselective Allylation Reaction of Aldehydes in an Aqueous Medium. Teck-Peng Loh, Jianrong Zhou. *Tetrahedron Lett.* **1999**, *40*, 9115
1. An enantioselective indium-mediated allylation reaction of aldehydes ketones in dichloromethane. Teck-Peng Loh, Jianrong Zhou, Xuruan Li. *Tetrahedron Lett.* **1999**, *40*, 9333

### [3] Patents (independent work at NTU)

6) New Phosphoramidtes As Supporting Ligands For Copper-Catalyzed Asymmetric Conjugate Addition For Organoboron Reagents. Inventors: 1) Zhou Jianrong Steve; 2) Wu Chunlin. Singapore provisional patent 10201501245U. 2015/2/17

5) Nickel-catalyzed asymmetric transfer hydrogenation of hydrazones for asymmetric synthesis of secondary alkylamines. Inventors: Zhou Jianrong Steve; Xu Haiyan. Singapore provisional patent 10201500086X. 2015/1/6

4) Nickel-catalyzed asymmetric transfer hydrogenation of prochiral olefins and applications to asymmetric synthesis of alpha- and beta- amino acids derivatives. Inventors: Zhou Jianrong Steve; Yang Peng; Xu Haiyan; Guo Siyu. Singapore provisional patent 10201405587X. 2014/9/9



3) Spiro-1,1'-biindane-7,7-bisphosphine oxides as highly active supporting ligands for palladium-catalyzed asymmetric Heck reaction. Inventors: Zhou, Jianrong Steve; Hu, Jian; Wu, Chunlin. PCT Int. Appl. WO 2014196930 A1 2014/12/11. PCT application No: PCT/SG2014/000260 2014/6/5. US Patent Appl. 14/896,289. 2015/12/4. European Patent Appl. 14 807 914.8 2015/12/29. China Application No. 201480044411.9 2016/2/4

2) Palladium-catalyzed asymmetric (hetero)arylation and vinylation of ketone enolates to produce tertiary stereocenters at alpha( $\alpha$ )-position. Inventors: Zhou, Jianrong; Huang, Zhiyan; Lim, Li Hui. PCT Int. Appl. WO 2014109712 A1 2014/07/17

1) New Chiral Phosphines for Palladium-Catalyzed Asymmetric alpha-Arylation of Ester Enolates to Produce Tertiary Stereocenters in High Enantioselectivity. Inventors: Jianrong (Steve) Zhou and Zhiyan Huang. WO 2013028132 A1 2012/8/17. Singapore patent application number 11201400085W. Date of filing: 17 August 2012. Date of grant: 05 August 2016. US patent application number 61/525,388. 19 AUGUST 2011

#### [4] Commercialization

2) Xyl-SDP(O) catalyst for asymmetric Heck reaction was licensed to Sigma-Aldrich, USA in 2014 (Catalog 798711)

1) DNPF catalyst for regioselective Heck reaction was commercialized by Sigma-Aldrich, USA in 2013 (Catalog L511501)

#### [5] Research Funds (Steve Zhou as PI)

7) MOE Tier-1 2016-T1-002-093. Title: Palladium-Catalyzed Reactions of Alkyl Halides: New Reactions and Application. S\$125,000. March 2017 to 28 February 2019

6) MOE Tier-1 2015-T1-001-166. Title: Asymmetric synthesis of carbocycles and heterocycles via palladium catalysis. S\$200,000. November 2015 to October 2018

5) MOE Tier-1 2014-T1-001-021. Title: Bifunctionalization of Arenes and Heteroarenes via Double CH Activation. S\$200,000. November 2014 to October 2016

4) Singapore Ministry of Education MOE Tier-2 MOE2013-T2-2-057. Title: Palladium-catalyzed asymmetric couplings of enolates. S\$700,055 (including indirect costs). April 2014 to March 2017

3) GSK Green and Sustainable Manufacturing Award. Title: Development of First Row Metal Catalysts for Asymmetric Hydrogenation of Olefins. S\$798,000 (including indirect costs). September 2013 to August 2017

2) Seed fund of Nanyang assistant professorship. Title: Transition metal catalysis. S\$500,000. August 2008 to August 2014

1) Singapore National Research Foundation fellowship NRF-2008-RF10. Title: Asymmetric catalytic [4+1] cycloadditions between dienes and carbene precursors. S\$3,830,040 (including indirect costs). August 2008 to October 2013