

## 傅宗政

南方科技大学环境科学与工程学院

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### 研究方向

空气污染、大气化学、化学-气候相互作用:

- 大气有机气体与有机气溶胶化学
- 气候与空气质量相互作用、云-气溶胶相互作用
- 大气痕量物质反演及遥感
- 污染物长程传输
- 大气痕量物质的海-气交换

### 教育经历 Education

- 2002.9 – 2007.9 美国哈佛大学地球与行星科学系博士  
2002.9 – 2005.6 美国哈佛大学工程与应用科学学院硕士  
2000.9 – 2002.6 台湾大学大气科学系硕士  
1996.9 – 2000.6 台湾大学大气科学系本科

### 工作经历 Professional experience

- 2019.4 – 南方科技大学环境科学与工程学院 教授  
2016.7 – 2019.4 北京大学物理学院大气与海洋科学系 长聘副教授、研究员  
2010.6 – 2016.7 北京大学物理学院大气与海洋科学系 百人计划研究员  
2008.1 – 2010.6 香港理工大学土木与结构工程系 助理教授  
2007.9 – 2007.12 美国哈佛大学工程与应用科学学院 博士后

### 荣誉 Honors

- 2012 国家自然科学基金委优秀青年基金  
2012 北京大学物理学院钟盛标青年教师奖  
2013 涂长望青年气象科技奖二等奖  
2015 教育部特聘青年学者  
2017 北京大学物理学院赵凯华教学奖  
2019 教育部高等学校科学研究优秀成果奖自然科学二等奖 (排名 1)

**发表论文 Publication** (\* denotes corresponding author, underline denotes students advised)

1. **Jiang, Z.**, Jolleys, M. D., **Fu, T.-M.\***, Palmer, P. I.\*, **Ma, Y.**, **Tian, H.**, Li, J., Yang, X. (2020), Spatiotemporal and probability variations of surface PM<sub>2.5</sub> over China between 2013 and 2019 and the associated changes in health risks: an integrative observation and model analyses, *Science of the Total Environment*, 723, doi: 10.1016/j.scitotenv.2020.137896.
2. **Zhang, L.**, **Fu, T.-M.\***, **Tian, H.**, **Ma, Y.**, Chen, J.-P., Tsai, T.-C., Tsai, I.-C., Meng, Z., Yang, X. (2020), Anthropogenic aerosols significantly reduce mesoscale convective system occurrences and precipitation over Southern China in April, *Geophys. Res. Lett.*, doi: 10.1029/2019GL086204.
3. Zhao, Y.-H., Zhang, L., Zhou, M., Chen, D., Lu, X., Tao, W., Liu, J.-F., **Tian, H.**, **Ma, Y.-P.**, **Fu, T.-M.** (2019), Influences of planetary boundary layer mixing parameterization on summertime surface ozone concentration and dry deposition over North China, *Atmospheric Environment*, 218, 116950, doi:10.1016/j.atmosenv.2019.116950.
4. Lu, X., Zhang, L., Chen, Y., Zhou, M., Zheng, B., Li, K., Liu, Y., Lin, J., **Fu, T.-M.**, and Zhang, Q. (2019), Exploring 2016–2017 surface ozone pollution over China: source contributions and meteorological influences, *Atmos. Chem. Phys.*, 19, 8339–8361, doi:10.5194/acp-19-8339-2019.
5. **Fu, T.-M.\*** and **H. Tian** (2019), Climate change penalty to ozone air quality: review of current understandings and knowledge gaps, *Current Pollution Reports*, 5, 159–171, doi:10.1007/s40726-019-00115-6.
6. Shen, L., D. J. Jacob, L. Zhu, Q. Zhang, B. Zheng, M. P. Sulprizio, K. Li, I. De Smedt, G. González Abad, **H. Cao**, **T.-M. Fu**, and H. Liao (2019), The 2005–2016 trends of formaldehyde columns over China observed by satellites: Increasing anthropogenic emissions of volatile organic compounds and decreasing agricultural fire emissions, *Geophysical Research Letters*, 46. doi:10.1029/2019GL082172 Full text.
7. **Feng, X.**, **T.-M. Fu\***, **H. Cao**, **H. Tian**, Q. Fan, X. Chen (2019), Neural network prediction of pollutant emissions from open burning of crop residues: application to air quality forecasts in Southern China, *Atmospheric Environment*, 204, 22-31, doi: 10.1016/j.atmosenv.2019.02.002
8. Zhou, M., L. Zhang, D. Chen, Y. Gu, **T.-M. Fu**, M. Gao, Y. Zhao, X. Lu, and B. Zhao (2018), The impact of aerosol-radiation interactions on the effectiveness of emission control measures, *Environmental Research Letters*, 14(2), 024002, doi:10.1088/1748-9326/aaf27d.
9. **Xing, L.**, M. Shrivastava\*, **T.-M. Fu\***, P. Roldin, Y. Qian, L. Xu, N. L. Ng, J. Shilling, A. Zelenyuk, and C. Cappa (2018), Parameterized yields of semi-volatile products from isoprene oxidation under different NO<sub>x</sub> levels: impacts of chemical aging and wall-loss of reactive gases, *Environmental Science and Technology*, 52(16), 9225-9234, doi:10.1021/acs.est8b00373.
10. **Cao, H.**, **T.-M. Fu\***, L. Zhang, D. K. Henze, C. Chan Miller, C. Lerot, G. Gonzalez Abad, I. De Smedt, Q. Zhang, M. van Roosendaal, K. Chance, J. Li, J. Zheng, and Y. Zhao (2018), Adjoint inversion of Chinese non-methane volatile organic compound emissions using space-based observations of formaldehyde and glyoxal, *Atmospheric Chemistry and Physics*, 18, 15017-15046, doi:10.5194/acp-18-15017-2018.
11. Liu, M., J. Lin, Y. Wang, Y. Sun, B. Zheng, J. Shao, L. Chen, Y. Zheng, **J. Chen**, **T.-M. Fu**, Y. Yan, Q. Zhang, and Z. Wu (2018), Spatiotemporal variability of NO<sub>2</sub> and PM<sub>2.5</sub> over Eastern China: observational and model analyses with a novel statistical

- method, *Atmospheric Chemistry and Physics*, 18, 12933-12952, doi:10.5194/acp-18-12933-2018.
12. Chen, Q.\*, **T.-M. Fu\***, J. Hu\*, Q. Ying, and L. Zhang (2017), Modelling secondary organic aerosols in China, *National Science Review*, doi:10.1093/nsr/nwx143.
  13. Li, N., J.-P. Chen, I.-C. Tsai, Q. He, S.-Y. Chi, Y.-C. Lin, and **T.-M. Fu** (2016), Potential impacts of electric vehicles on air quality in Taiwan, *Science of the Total Environment*, 566-567, 919-928, doi:10.1016/j.scitotenv.2016.05.105.
  14. **Xu, W.**, **T.-M. Fu\***, **J. Chen**, and **H. Tian** (2016), Ground-based measurement and variation analysis of carbonaceous aerosols in Wuqing, *Acta Scientiarum Naturalium Universitatis Pekinensis*, 52(3), 409-419, doi:10.13209/j.0479-8023.2015.144. (In Chinese)
  15. Tsai, I.C., J.-P. Chen, C.S.-C. Lung, **N. Li**, W.-N. Chen, **T.-M. Fu**, C.-C. Chang, and G.-D. Hwang (2015), Sources of organic aerosol in a subtropical metropolis during summer, *Atmospheric Environment*, 117, 51-60, doi:10.1016/j.atmosenv.2015.07.005.
  16. **Fu, T.-M.\***, **Y. Zheng**, F. Paulot, J. Mao, and R.M. Yantosca (2015), Positive but variable sensitivity of August surface ozone to large-scale warming in the southeast United States, *Nature Climate Change*, 5, 454-458, doi:10.1038/nclimate2567.
  17. Zhang, L., L. Liu, Y. Zhao, S. Gong, X. Zhang, D.K. Henze, S.L. Capps, **T.-M. Fu**, and Q. Zhang (2015), Source Attribution of Particulate Matter Pollution over North China with the Adjoint Method, *Environmental Research Letters*, 10, 084011, doi:10.1088/1748-9326/10/8/084011.
  18. **Xing, L.**, and **T.-M. Fu\*** (2015), Contributions of organic aerosols to cloud condensation nuclei numbers in China, *Acta Scientiarum Naturalium Universitatis Pekinensis*, 51(1), 13-23, doi:10.13209/j.0479-8023.2014.143. (In Chinese)
  19. **Jian, Y.**, and **T.-M. Fu\*** (2014), Injection heights of springtime biomass burning plumes over the Peninsular Southeast Asia and their impacts on pollutant long-range transport, *Atmospheric Chemistry and Physics*, 14, 3977-3989, doi:10.5194/acp-14-3977-2014.
  20. **Li, N.**, **T.-M. Fu\***, J.J. Cao, S.C. Lee, X.-F. Huang, L.-Y. He, K.-F. Ho, J. S. Fu, and Y.-F. Lam (2013), Sources of secondary organic aerosols in the Pearl River Delta region in fall: contributions from the aqueous reactive uptake of dicarbonyls, *Atmospheric Environment*, 76, 200-207, doi:10.1016/j.atmosenv.2012.12.005.
  21. Zhang, Y., L. Qiao, **Y. Ren**, X. Wang, M. Gao, Y. Tang, J.J. Xi, **T.-M. Fu\***, and X. Jiang (2013), Two dimensional barcode-inspired automatic analysis for arrayed microfluidic immunoassays, *Biomicrofluidics*, 7, 034110, doi:10.1063/1.4811278.
  22. **Xing, L.**, **T.-M. Fu\***, J.J. Cao, S.C. Lee, G.H. Wang, K.-F. Ho, M.-C. Cheng, C.-F. You, and T.J. Wang (2013), Seasonal and spatial variability of the organic matter-to-organic carbon mass ratios in Chinese urban organic aerosols and a first report of high correlations between aerosol oxalic acid and zinc, *Atmospheric Chemistry and Physics*, 13, 4307-4318, doi:10.5194/acp-13-4307-2013.
  23. **He, C.**, and **T.-M. Fu\*** (2013), Air-sea exchange of volatile organic compounds: a new model with microlayer effects, *Atmospheric and Oceanic Science Letter*, 6(2), 97-102.
  24. **Fu, T.-M.\***, J.J. Cao, X.Y. Zhang, S.C. Lee, Q. Zhang, Y.M. Han, W.J. Qu, Z. Han, R. Zhang, Y.X. Wang, D. Chen, and D.K. Henze (2012), Carbonaceous aerosols in China:

- top-down constraints on primary sources and estimation of secondary contribution, *Atmospheric Chemistry and Physics*, 12, 2725-2746, doi:10.5194/acp-12-2725-2012.
25. Heald, C.L., H. Coe, J.L. Jimenez, R.J. Weber, R. Bahreini, A.M. Middlebrook, L.M. Russell, M. Jolleys, **T.-M. Fu**, J.D. Allan, K.N. Bower, G. Capes, J. Crosier, W.T. Morgan, N. H. Robinson, P.I. Williams, M.J. Cubison, P.F. DeCarlo, and E.J. Dunlea, Exploring the vertical profile of atmospheric organic aerosol: comparing 17 aircraft field campaigns with a global model, *Atmospheric Chemistry and Physics*, 11, 12673-12696, doi:10.5194/acp-11-12673-2011.
  26. Pacifico, F., S.P. Harrison, C.D. Jones, A. Arneth, S. Sitch, G.P. Weedon, M.P. Barkley, P.I. Palmer, D. Seca, M. Potosnak, **T.-M. Fu**, A. Goldstein, J. Bai, and G. Schurgers (2011), Evaluation of a photosynthesis-based biogenic isoprene emission scheme in JULES and simulation of isoprene emissions under present-day climate conditions, *Atmospheric Chemistry and Physics*, 11, 4371-4389, doi:10.5194/acp-11-4371-2011.
  27. González Abad, G., N.D.C. Allen, P.F. Bernath, C.D. Boone, S.D. McLeod, G.L. Manney, G.C. Toon, C. Carouge, Y. Wang, S. Wu, M.P. Barkley, P.I. Palmer, Y. Xiao, and **T.-M. Fu** (2011), Ethane, ethyne and carbon monoxide concentrations in the upper troposphere and lower stratosphere from ACE and GEOS-Chem: a comparison study, *Atmospheric Chemistry and Physics*, 11(18), 9927-9941, doi:10.5194/acp-11-9927-2011.
  28. Zhang, Y.W., Z.L. Gu, S.C. Lee, **T.-M. Fu**, and K.F. Ho (2011), Numerical simulation and in situ investigation of fine particle dispersion in an actual deep street canyon in Hong Kong, *Indoor and Built Environment*, 20, 2, 206-216, doi:10.1177/1420326X10387694.
  29. **Fu, T.-M.\***, D.J. Jacob, and C.L. Heald (2009), Aqueous-phase reactive uptake of dicarbonyls as a source of organic aerosol over eastern North America, *Atmospheric Environment*, 43(10), doi:10.1016/j.atmosenv.2008.12.029.
  30. Guo, H., A.J. Ding, T. Wang, I.J. Simpson, D.R. Blake, B. Barletta, S. Meinardi, **T.-M. Fu**, Y.S. Li, and W.T. Hung (2009), Source origins, modeled profiles and apportionments of halogenated hydrocarbons in the greater Pearl River Delta region, southern China, *Journal of Geophysical Research - Atmosphere*, doi:10.1029/2008JD011448.
  31. Jacob, D.J., E.E. Drury, T.-M. Fu, E. Leibensperger, L. Mickley, A. Tai (2009), Aerosols over the United States: space observation, source characterization, and climate interactions, *Geochimica et Cosmochimica Acta*, 73(13), A579-A579.
  32. **Fu, T.-M.\***, D.J. Jacob, F. Wittrock, J.P. Burrows, M. Vrekoussis, and D.K. Henze (2008), Global budgets of atmospheric glyoxal and methylglyoxal, and implications for formation of secondary organic aerosols, *Journal of Geophysical Research - Atmosphere*, 113, D15303, doi:10.1026/2007JD009505.
  33. Henze, D.K., J.H. Seinfeld, N.L. Ng, J.H. Kroll, **T.-M. Fu**, D.J. Jacob, and C.L. Heald (2008), Global modeling of secondary organic aerosol formation from aromatic hydrocarbons: high- vs. low-yield pathways, *Atmospheric Chemistry and Physics*, 8, 2405-2401, doi:10.5194/acp-8-2405-2008.
  34. Liu, C.-M., M.-T. Yeh, S. Paul, Y.-C. Lee, D.J. Jacob, **T.-M. Fu**, J.-H. Woo, G.R. Carmichael, and D.G. Streets (2008), Effect of anthropogenic emissions in East Asia on regional ozone levels during spring cold continental outbreaks near Taiwan: a case

- study, *Environmental Modeling Software*, 23(5), 579-591, doi:10.1016/j.envsoft.2007.08.007.
35. Millet, D.B., D.J. Jacob, K.F. Boersma, **T.-M. Fu**, T.P. Kurosu, K. Chance, C.L. Heald, and A. Guenther (2007), Spatial distribution of isoprene emissions from North America derived from formaldehyde column measurements by the OMI satellite sensor, *Journal of Geophysical Research - Atmosphere*, 113, D02307, doi:10.1029/2007JD008950.
  36. **Fu, T.-M.\***, D.J. Jacob, P.I. Palmer, K. Chance, Y X. Wang, B. Barletta, D.R. Blake, J.C. Stanton, and M. J. Pilling (2007), Space-based formaldehyde measurements as constraints on volatile organic compound emissions in East and South Asia, *Journal of Geophysical Research - Atmosphere*, 112(D6), D06312, doi:10.1029/2006JD007853.
  37. Wang, Y.X., M. B. McElroy, R. V. Martin, D. G. Streets, Q. Zhang, and **T.-M. Fu** (2007), Seasonal variability of NO<sub>x</sub> emissions over east China constrained by satellite observations: Implications for combustion and microbial sources, *Journal of Geophysical Research - Atmosphere*, 112, D06301, doi:10.1029/2006JD007538.
  38. Sauvage, B., R. V. Martin, A. van Donkelaar, X. Liu, K. Chance, L. Jaegle, P. I. Palmer, S. Wu, and **T.-M. Fu** (2007), Remote sensed and in situ constraints on processes affecting tropical tropospheric ozone, *Atmospheric Chemistry and Physics*, 7, 815-838, doi:10.5194/acp-7-815-2007.
  39. van Donkelaar, A., R. V. Martin, R. J. Park, C. L. Heald, **T.-M. Fu**, H. Liao, and A. Guenther (2007), Model evidence for a significant source of secondary organic aerosol from isoprene, *Atmospheric Environment*, 41, 1267-1274, doi:10.1016/j.atmosenv.2006.09.051.
  40. Palmer, P.I., D.S. Abbot, **T.-M. Fu**, D.J. Jacob, K. Chance, T.P. Kuruso, A. Guenther, C. Wiedinmyer, J.C. Stanton, M.J. Pilling, S.N. Pressley, B. Lamb, and A.L. Sumner (2006), Quantifying the seasonal and interannual variability of North American isoprene emissions using satellite observations of formaldehyde column, *Journal of Geophysical Research - Atmosphere*, 111, D12315, doi:10.1029/2005JD006689.
  41. Liu, X., K. Chance, C.E. Sioris, T.P. Kurosu, R.J.D. Spurr, R.V. Martin, **T.-M. Fu**, J.A. Logan, D.J. Jacob, P.I. Palmer, M.J. Newchurch, I.A. Megretskiaia, and R. Chatfield (2006), First directly-retrieved global distribution of tropospheric column ozone from GOME: comparison with the GEOS-CHEM model, *Journal of Geophysical Research - Atmosphere*, 111, D02308, doi:10.1029/2005JD006564.
  42. Jiang, X., Q. Xu, S.K.W. Dertinger, A.D. Stroock, **T.-M. Fu**, and G.M. Whitesides (2005), A general method for patterning gradients of biomolecules on surfaces using microfluidic networks, *Analytical Chemistry*, 77(8), 2338-2347, doi:10.1021/ac048440m.

### 邀请报告 **Invited talks (selected)**

1. Fu, T.-M. et al., Space-based constraints on Chinese NMVOC emissions and impacts on regional air quality, Telluride Workshop on New Insights into Gas Phase Atmospheric Chemistry, July 23-28, 2018, Telluride, USA
2. Fu, T.-M. et al., Neural network prediction of agricultural waste burning in southern and northern China to benefit air quality management, The 5<sup>th</sup> International Workshop on Regional Air Quality Management, November 14-17, 2017, Guangzhou, China

3. Fu, T.-M. et al., Space-based constraints on biogenic and anthropogenic VOC emissions: exploring the sources of uncertainties, Gordon Research Conference on Biogenic Hydrocarbons and the Atmosphere, June 28-July 3, 2016, Girona, Spain
4. Fu, T.-M. et al., Space-based constraints on Chinese and global NMVOC emissions: exploring the sources of uncertainties, AGU Fall Meeting, December 9-13, 2016, San Francisco, USA
5. Fu, T.-M. et al., Diagnosing the sensitivity of air quality to climate warming, Telluride Workshop on New Insights into Gas Phase Atmospheric Chemistry, July 18-22, 2016, Telluride, USA
6. Fu, T.-M. et al., Sensitivity of surface ozone and PM<sub>2.5</sub> to the interannual variability of climate: the role of BVOCs, Gordon Research Conference on Biogenic Hydrocarbons and the Atmosphere, June 28-July 4, 2014, Girona, Spain.
7. Fu, T.-M. et al., Carbonaceous aerosols in China: constraints on primary emissions and secondary formation pathways, The 7<sup>th</sup> World Conference on Particulate Technology, May 19-22, 2014, Beijing, China
8. Fu, T.-M. et al., Carbonaceous aerosols in China: constraints on primary sources and estimation of secondary contribution, The 4<sup>th</sup> International Workshop on Regional Air Quality Management, January 14-17, 2014, Hong Kong, China
9. Fu, T.-M. et al., Air-sea exchange of volatile organic compounds: a new model with microlayer effects, Future of SOLAS Advisory Team Workshop, December 3-5, 2013, Plymouth, UK
10. Fu, T.-M. et al., Carbonaceous aerosols in China: constraints on primary sources and estimation of secondary contribution, National Natural Science Foundation ShuangQing Forum, November 17-19, 2012, Beijing, China
11. Fu, T.-M. et al., Aqueous-phase reactive uptake of dicarbonyls as a source of organic aerosol over eastern North America and China, The 2<sup>nd</sup> International Workshop on Regional Air Quality Management in Rapidly Developing Economic Regions, November 9-10, 2012, Guangzhou, China
12. Fu, T.-M. et al., Carbonaceous aerosols in China: top-down constraints on primary sources and estimation of secondary contribution, The 7<sup>th</sup> Asian Aerosol Conference, August 17-20, 2011, Xi'an, China
13. Fu, T.-M. et al., Atmospheric glyoxal and methylglyoxal: their role as SOA precursors and their potential as diagnostics for surface O<sub>3</sub> sensitivity, AGU Fall Meeting, December 9-13, 2009, San Francisco, USA

## 学术活动 Professional activities

### Committees and professional membership:

Chinese Environmental Science Society, Professional Committee for Pollution Prevention & Control of Volatile Organic Compounds (Expert member)

Nanjing University of Information Science and Technology, Earth System Modeling Center Scientific Advisory Committee (Board member)

Integrated Land Ecosystem-Atmosphere Processes Study (iLEAPS) China Committee (Board member)

Chinese Meteorological Society  
American Geophysical Union

### Conferences:

Session co-chair for Asia Oceania Geosciences Society Annual Meeting (2010, 2015, 2017)  
Local organizer for International Global Atmospheric Chemistry (IGAC) Open Science Conference Young Scientist Program (2012)  
Organizer for the 1<sup>st</sup> National Atmospheric and Oceanic Sciences PhD Student Forum (2011)  
Organizer for the 3<sup>rd</sup> Gezhi Forum for Young Scientists, Peking University School of Physics (2011)

### Editorial work:

Associate editor for *The Hong Kong Institute of Engineers Transactions* (2008-2010)  
Guest editor for *Atmospheric Environment, special issue on air pollution over the Yangtze River Delta* (2015)

### Reviews:

Proposal reviewer for the National Natural Science Foundation of China, the Hong Kong Research Grant Council  
Reviewer for *Proceedings of the National Academy of Sciences, Journal of Geophysical Research, Geophysical Research Letters, Atmospheric Chemistry and Physics, Atmospheric Environment, Global Biogeochemical Cycle, Atmospheric Research, Tellus, Journal of the Air & Waste Management Association, Asia-Pacific Journal of Atmospheric Sciences, Advances in Atmospheric Sciences*  
Reviewer for Acid Deposition Monitoring Network in East Asia (EANET) Report: *Review on the State of Air Pollution in East Asia*, 2014

## 科研项目 Research grants

Total grants as PI/Co-PI/Co-I at Peking University: 9.73 million RMB

1. Multi-scale coupled air quality forecast model system  
National Key Research Development Program (科技部国家重点研发计划) (No. 2017YFC0209802), 2017-2020, 1M (out of 5.57M) RMB, Co-I (课题学术骨干)
2. High-resolution study of chemistry-climate interaction over China  
National Basic Research Program of China (973 项目课题) (No. 2014CB441303), 2014-2018, 4.86M (out of 13.5M) RMB, Co-PI (课题负责人)
3. Impact of aerosol physics and chemistry on the haze over Taiwan Strait and surrounding areas  
National Natural Science Foundation of China Collaborative Funding with Taiwan (基金委两岸合作项目) (No. 4141101076), 2015-2017, 2M RMB, PI
4. Atmospheric organic gases and organic aerosols

- National Natural Science Foundation of China Outstanding Young Scientist Fellowship (基金委优青项目) (No. 412220093), 2013-2015, 1M RMB, PI
5. Constraining Chinese volatile organic gas emissions using satellite observations of formaldehyde and glyoxal  
National Natural Science Foundation of China General Research Grant (基金委面上项目) (No. 41175101), 2012-2015, 0.75M RMB, PI
  6. Numerical parameterization for the activation of organic aerosols  
Chinese Ministry of Education Research Grant (教育部博士点基金) (No. 20110001110090), 2012-2014, 120K RMB, PI
  7. Primary emissions and secondary formation pathways of carbonaceous aerosol in the Pearl River Delta Region: a regional model synthesis  
Hong Kong Research Grant Council General Research Fund, 2009-2010, 0.4M HKD, PI
  8. Development of cloud and aerosol parameterizations for climate models  
“National Science Foundation (of Taiwan) Integrated Research Grant” (台湾“国家科学委员会”整合型计划), 2011-2016, 26M TWD, Co-PI
  9. Reconstruction of the history of aerosol concentrations and database  
Chinese Academy of Sciences Strategic Program (中科院先导专项碳专项) (No. XDA05100401), 2011-2015, 200K RMB, Co-I (课题学术骨干)