

Trends in Chinese Chemical Research

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Presentation Outline:

- ❖ Overview of Chinese Chemical research Development
- ❖ Main Progress in Chinese Chemical Research
- ❖ Main National Research Programs
- ❖ Online Resources Available for China Chemical Research



Overview of Chinese Chemical research Development

- ❖ China has become the world's third largest research and development (R&D) performer (behind only the United States and Japan) ^[1]
- ❖ China's total citation rate has also been on an increase at an exponential rate during the last decade ^[2,3]

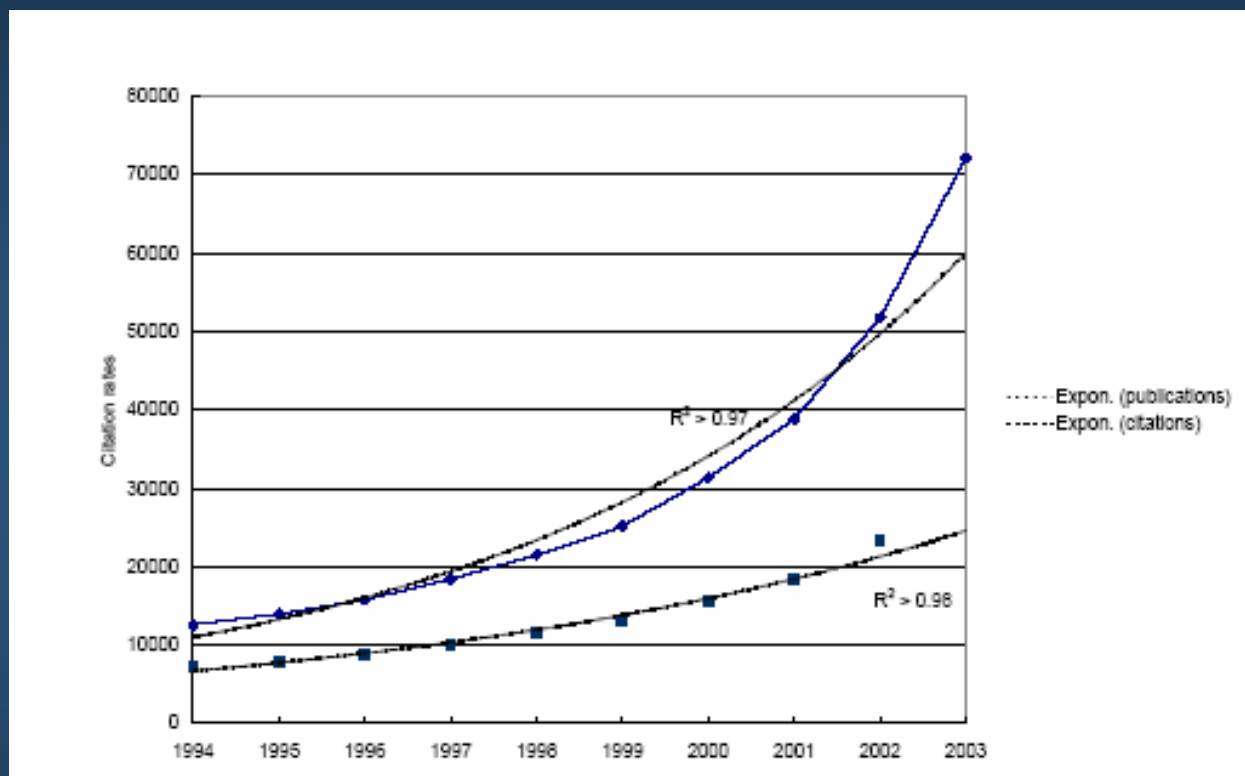
[1] Fact Sheet: Science and Engineering Indicators, 2006: Excerpts, February 23, 2006,
http://www.nsf.gov/news/news_summ.jsp

[2] ISTIC, 2003. 2002年度中国科技论文统计结果 (Statistic results of Chinese science and technology publications in 2002), Beijing.

[3] ISTIC, 2004. 2003年度中国科技论文统计结果 (Statistic results of Chinese science and technology publications in 2003), Beijing



Overview of Chinese Chemical research Development



- Figure shows the increase of China's Citation rate for publications with a Chinese address for the first author during the preceding ten years.

[1] Ping Zhou, Loet Leydesdorff, The Emergence of China as a Leading Nation in Science: <http://www.leydesdorff.net/ChinaScience/ChinaScience.pdf>



Overview of Chinese Chemical research Development

- ❖ Chinese **chemical** research has more than tripled since 1989 (statistics from CA) [2,3]
- ❖ As of 2005, 128 out of 1,000 journal titles are most frequently cited in CA (**CA 1000**), 920 journal titles were included in **CA** [2,3,4]

[1] Chemical Abstracts Service Source Index Quarterly No.4, 2004
[2] Chemical Abstracts: Vol.140 Issue 1-26, Vol.141 Issue 1-26, 2005
[3] China Science Citation Index, <http://www.sci.com.cn/>, August 30, 2006



Overview of Chinese Chemical research Development

- ❖ China is actively involved in the research of [1,2,3,4]
 - ❖ Materials synthesis and characterization (e.g. catalysts and nano-materials),
 - ❖ Asymmetric catalyzed reactions in organic chemistry
 - ❖ Structure determination data acquiring
 - ❖ Software suite for macromolecular structure determination in computational chemistry
 - ❖ Molecular electronic devices in nano-chemistry
 - ❖ Highly efficient metathesis polymerization

[1] XG Zou, WZ Xia, and WP Liang, *A Comparison of Hot Chemical Research Areas in China and Abroad*, *China Basic Science*, 2003, 4, 7-40.

[2] *China Science Citation Index*, <http://www.sci.com.cn/>, August 30, 2006

[3] *The Chinese Academy of Sciences, Science and Technology Progress in China*, Available at: <http://english.cas.cn/eng2003/page/S&T/PSRT.htm>, August 28, 2006

[4] *Ministry of Science and Technology of the People's Republic of China, S&T Statistics Data Book*, Available at: <http://www.most.gov.cn/>, July 21, 2006



Main Progress in Chinese Chemical Research

1. Nanotechnology

- ❖ 1990-2002, nearly 1000 projects, with \$27 million funding were implemented. ^[1]
- ❖ Developments encompass nanodevices, nanobiology & medicine, detection & characterization, modeling and simulation ^[1]
- ❖ Carbon nanotubes (CNTs): all carbon tubes with diameter comparable to DNA are available in two varieties: single-walled or multi-walled ^[3,4]

[1] Ministry of Science and Technology of the People's Republic of China, S&T Statistics Data Book, Available at: <http://www.most.gov.cn/>, July 21, 2006

[2] Chunli Bai, Ascent of Nanoscience in China, *SCIENCE*, 309,61.

[3] Ci Lijie, Xie Sishen, Tang Dongsheng, Yan Xiaoqin, Li Yubao, Liu Zuqin, Zou Xiaoping, Zhou Weiya, et al. Controllable growth of single wall carbon nanotubes by pyrolyzing acetylene on the floating iron catalysts, *Chemical Physics Letters*, 2001, 349, 191-195

[4] K Jiang, Q Li, S Fan, Spinning continuous carbon nanotube yarns, *NATURE*, 2002, 419, 801



Main Progress in Chinese Chemical Research

1. Nanotechnology (continued)

- ❖ Template-based growth method invented in CAS can control both the diameter and growth direction of the multi-walled carbon ^[1]
- ❖ Yarns made by carbon tubes and woven into a variety of macroscopic objects, such as bulletproof vests and materials that block electromagnetic waves. ^[1,2]
- ❖ Superplastic property of nanostructured copper. It can be elongated at RT to more than 50 times its original length without breaking. ^[1,2,3]
- ❖ Copper growth twins, a specific type of crystalline microstructure. Tensile strength can be 10 times greater than its conventional counter part, while retaining the conductivity. ^[1,2,3]

[1] Ci Lijie, Xie Sishen, Tang Dongsheng, Yan Xiaoqin, Li Yubao, Liu Zuqin, Zou Xiaoping, Zhou Weiya, et. al. Controllable growth of single wall carbon nanotubes by pyrolyzing acetylene on the floating iron catalysts, *Chemical Physics Letters*, 2001, 349, 191-195

[2] K Jiang, Q Li, S Fan, *Spinning continuous carbon nanotube yarns*, *NATURE*, 2002, 419, 801

[3] Lu, Y Shen, X Chen, L Qian, K Lu, *Ultra-high Strength and High Electrical Conductivity in Copper*, *Science*, 2004 304, 422



Main Progress in Chinese Chemical Research

2. Advanced material synthesis and characterization ^[1,2,3]

- ❖ Rare earth-transitional metal magnetic material
- ❖ Nonlinear optical crystal barium borate and lithium triborate (LBO)
- ❖ Fiber enhanced ceramic composite materials
- ❖ High temperature superconduction material of YtBaCuO₂. It has proceeded to the production phase
- ❖ Coaxial cable at nanometer level
- ❖ 50X super-plastic ductile deformation of nanometer metal copper forecasting the coming of material processing revolution
- ❖ Completely ordered metal nanometer lattice growth

[1] Chunli Bai, *Ascent of Nanoscience in China*, SCIENCE, 309,61.

[2] K Jiang, Q Li, S Fan, *Spinning continuous carbon nanotube yarns*, NATURE, 2002, 419, 801

[3] Lu, Y Shen, X Chen, L Qian, K Lu, *Ultra-high Strength and High Electrical Conductivity in Copper*, Science, 2004 304, 422



Main Progress in Chinese Chemical Research

3. Asymmetric catalytic reactions [1,2]

- ❖ Catalytic methods to prepare one of the enantiomers in reference to the other.
- ❖ A chiral catalyst is used to produce large quantities of an optically active compound from a precursor that may be chiral or achiral
- ❖ Convert prochiral substrates into chiral products with high enantioselectivity
- ❖ These development has enormous impact on industrial organic synthesis
- ❖ Many papers has been cited more than 110 times in ISI highly ranked journals

[1] An-Hu Li and Li-Xin Dai, Varinder K. Aggarwal, *Asymmetric Ylide Reactions: Epoxidation, Cyclopropanation, Aziridination, Olefination, and Rearrangement*, *Chemical Reviews*, 1997, 97, 2342

[2] Chunli Bai, *Ascent of Nanoscience in China*, *SCIENCE*, 309,61.



National Research Program

1. High-tech R&D program (the 863 program) ^[1,2]
 - ❖ Aiming at developing nano-material for the development of aviation, the maglev train, information storage and access leading to the upgrading of China's manufacturing industry.
 - ❖ By 2005,
 - ❖ \$1.7 billion (government)
 - ❖ \$3 billion (enterprise, etc)
 - ❖ 7,200 projects
 - ❖ More than 300 topics in biotech, info tech, energy, material, telecommunication, marine tech
 - ❖ By 2005, 421 patents in this area has been submitted.

[1] www.863.org.cn, July 17, 2006

[2] Ministry of Science and Technology of the People's Republic of China, S&T Statistics Data Book, Available at: <http://www.most.gov.cn/>, July 21, 2006



National Research Program

2. Key basic research program (the 973 program) ^[1,2]

- ❖ Strengthen major basic researches and support interdisciplinary innovations
- ❖ \$3 million, 60 projects in math, life science, info sciences material sciences, energy and environment.

[1] www.973.org.cn, July 17, 2006

[2] Ministry of Science and Technology of the People's Republic of China, S&T Statistics Data Book, Available at: <http://www.most.gov.cn/>, July 21, 2006



National Research Program

2. Key basic research program (the 973 program) [1,2]

- ❖ Projects supported by 973 program:
 - ❖ Super-thin carbon nanometer pipe with the inside diameter of 0.5mm
 - ❖ Nanometer copper with electro-deposit technology
 - ❖ First discovered and proved the existence of super-lattice vibration and electromagnetic waves coupling within dielectric crystal lattice composed of piezoelectric & ferroelectric materials
 - ❖ Production on high-quality big crystal e.g. YCOB, Nd:YCOB, GCOB and proved that the most effective power output direction is not on the main plane as long believed.
 - ❖ Obtained YCOB direct double frequency with green light output efficiency 155% higher than previously reported worldwide.



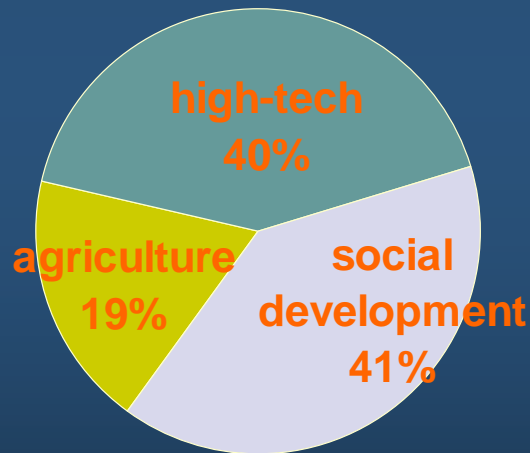
[1] www.973.org.cn, July 17, 2006

[2] Ministry of Science and Technology of the People's Republic of China, S&T Statistics Data Book, Available at: <http://www.most.gov.cn/>, July 21, 2006

National Research Program

3. “Five-year” plans

\$1.5 billion investment for the ninth “Five-year”



[1] <http://gongguan.jhgl.org/>, July 17, 2006

[2] Ministry of Science and Technology of the People's Republic of China, S&T Statistics Data Book, Available at: <http://www.most.gov.cn/>, July 21, 2006



Online Research Resources

- ❖ ISTIC (Institute of Scientific and Technical Information of China): ^[1,2,3]
 - ❖ A government agency, a division of the **Chinese Ministry of Science & Technology**
 - ❖ **Scientific Evaluation:** The China Scientific and Technical Papers and Citation Databases (CSTPCD), in a format similar to SCI ^[2]
 - ❖ **Journal Evaluation:** the authoritative institute to evaluate science journals in China
 - ❖ In 1993, founded “**Wanfang Data Co., Ltd.**” to produce and market a wide range of online research resources **on behalf of ISTIC**

[1] Ministry of Science and Technology of the People's Republic of China, *S&T Statistics Data Book*, Available at: <http://www.most.gov.cn/>, July 21, 2006

[2] <http://cstpdc.istic.ac.cn/cstpdc/introduce.html>, September 01, 2006

[3] <http://www.istic.ac.cn/>, September 01, 2006



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- ❖ A wide range of electronic full-text resources, including :
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 - ❖ www.oriprobe.com
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- ❖ **China Online Journals (COJ)**, including 99% of **core journals** in China
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- ❖ *Example: Some English Journal Titles (cited by both CA100 and SCI):*



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					SCI	CA1000	CA
1	Acta Pharmaceutica Sinica	1998-	Monthly	0513-4870		Yes	Yes
2	Biomedical and Environmental Sciences	1999-	Bimonthly	0895-3988	Yes		
3	Chemical Research in Chinese Universities	2000-	Bimonthly	1005-9040	Yes	Yes	Yes
4	Chinese Chemical Letters	2000-	Monthly	1001-8417	Yes	Yes	Yes
5	Chinese Journal of Chemical Engineering	1998-	Bimonthly	1004-9541	Yes		Yes
6	Chinese Journal of Chemical Physics	2000-	Bimonthly	1003-7713	Yes		Yes
7	Chinese Journal of Structural Chemistry	1999-	Monthly	0254-5861	Yes	Yes	Yes
8	Chinese Medical Journal	1998-	Semi-monthly	0366-6999	Yes	Yes	Yes
9	Chinese Science Bulletin	2000-	Semi-monthly	1001-6538	Yes	Yes	Yes
10	Journal of Environmental Sciences	1998-	Bimonthly	1001-0742	Yes	Yes	Yes
11	Journal of Materials Science & Technology	2000-	Bimonthly	1005-0302	Yes		Yes
12	Science In China (Chemistry)	2000-	Bimonthly	1006-9291	Yes		Yes
13	Transactions of Nonferrous Metals Society of China	1999-	Bimonthly	1003-6326	Yes		Yes



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