



浅谈新旧动能转换 新常态下的化工与环保

Brief Discussion On Chemical Industry & Environmental Protection
Under the New Normal State of New and Old Kinetic Energy Conversion



达建文
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前言

Introduction

习总书记关于创新驱动的论述

- “面对日益激烈的国际竞争，我们必须把创新摆在国家发展全局的核心位置。”
- “深入贯彻创新、协调、绿色、开放、共享的发展理念，立足自身优势，加强改革创新，努力闯出新路，奋力开创经济社会发展新局面。”
- “应该鼓励和支持企业成为研发主体、创新主体、产业主体，鼓励和支持企业布局前沿技术，推动核心技术自主创新，创造和把握更多机会，参与国际竞争，拓展海外发展空间。”

Chairman Xi Jinping's Exposition on Innovation Driving

- “In the face of increasingly fierce international competition, we must put innovation at the core of the overall national development.”
- We should thoroughly implement the concept of **innovation, coordination, green, open and shared** development, strengthen reform and innovation based on our own advantages, strive to break new paths and create a new situation for economic and social development.”
- “**Enterprises should be encouraged and supported to become the main body of R&D, innovation and industry.** Enterprises should be encouraged and supported to lay out frontier technologies, promote independent innovation of core technologies, create and seize more opportunities, participate in international competition and expand overseas development space.”

2017年4月李克强总理在山东考察

Premier Li Keqiang's visit to Shandong in April 2017



我国正处于新旧动能转换关键期。希望在以习近平同志为核心的党中央坚强领导下，山东贯彻落实新发展理念，**加快推动新旧动能转换**，积极探索解决重点民生问题的改革经验，为巩固全国经济稳中向好势头提供重要支撑。

Our country is in the critical period of new and old kinetic energy conversion. It is hoped that under the strong leadership of the Party Central Committee with Comrade Xi Jinping as its core, Shandong will implement the new development concept, **accelerate the transformation of old and new momentum**, actively explore the reform experience of solving key livelihood issues, and provide important support for consolidating the steady and good momentum of the national economy.

山东省委提出加快新旧动能转换

Shandong Provincial Committee proposes to speed up the conversion of new and old kinetic energy



落实好以习近平同志为核心的党中央对山东工作的希望和要求，关键要抓住新旧动能转换这个牛鼻子，在转方式调结构上下功夫。

In order to fulfill the hope and requirement of the CPC Central Committee with Comrade Xi Jinping as its core for Shandong's work, the key is to grasp the cow nose of the **transformation of old and new kinetic energy** and make great efforts to adjust the structure in the way of transformation.

新旧动能转换是山东推进供给侧结构性改革的重要举措！

The conversion of new and old kinetic energy is an important measure to promote the structural reform of supply side in Shandong Province.

党的十八届五中全会提出创新发展理念

The Fifth Plenary Session of the Eighteenth Central Committee of the CPC put forward the idea of innovative development

- ◆ 培育发展新动力，优化劳动力、资本、土地、技术、管理等要素配置，激发创新创业活力，推动大众创业、万众创新，释放新需求，创造新供给，推动新技术、新产业、新业态蓬勃发展。
- ◆ 实施网络强国战略，实施“互联网+”行动计划，发展分享经济，实施国家大数据战略。
- ◆ 大力推进农业现代化。构建产业新体系，加快建设制造强国，实施《中国制造2025》，实施工业强基工程，培育一批战略性新兴产业，开展加快发展现代服务业行动。
- ◆ We should foster new driving forces for development, optimize the allocation of labor, capital, land, technology and management, stimulate the vitality of innovation and entrepreneurship, promote mass entrepreneurship and innovation, release new demands, create new supplies, and promote the vigorous development of **new technologies, new industries and new formats**.
- ◆ We should implement the strategy of **network power**, implement the "Internet +" action plan, develop the **sharing economy** and implement the national **big data** strategy.
- ◆ We will vigorously promote agricultural modernization. We should **build a new industrial system**, speed up the construction of a powerful manufacturing country, implement Made in China 2025, implement a strong industrial base project, cultivate a number of strategic industries and carry out actions to speed up the development of modern service industries.

李克强总理政府工作报告摘要

Summary of Premier Li Keqiang's Government Work Report

必须把改善供给侧结构作为主攻方向，通过**简政减税、放宽准入、鼓励创新**，持续激发微观主体活力，减少无效供给、扩大有效供给，更好适应和引导需求。这是一个化蛹成蝶的转型升级过程，既充满希望又伴随阵痛，既非常紧迫又艰巨复杂。要勇往直前，坚决闯过这个关口。

Improvement of supply-side structure must be taken as the main direction of attack. By **simplifying administration and reducing taxes, relaxing access and encouraging innovation**, we can continuously stimulate the vitality of micro-subjects, reduce ineffective supply, expand effective supply and better adapt to and guide demand. This is a transformation and upgrading process of pupation into butterflies, full of hope and accompanied by pain, which is both very urgent and arduous and complex. We must go forward bravely and resolutely break through this barrier.

我国发展到现在这个阶段，不靠改革创新没有出路。我们拥有世界上数量最多、素质较高的劳动力，有最大规模的科技和专业技能人才队伍，蕴藏着巨大的创新潜能。要坚持以改革开放为动力、以人力人才资源为支撑，加快创新发展，培育壮大新动能、改造提升传统动能，推动经济保持中高速增长、产业迈向中高端水平。

At this stage of China's development, there is no way out without reform and innovation. We **have the world's largest number of high-quality labor force, the largest number of scientific and technological and professional skilled personnel, with tremendous potential for innovation.** We should persist in taking reform and opening-up as the driving force and human resources as the support, speed up innovation and development, foster and strengthen new momentum, transform and upgrade traditional momentum, and promote economic growth at medium and high speed, and industry to a high-end level.

根本目标

Fundamental Goals

转方式、调结构，实现创新驱动发展和可持续发展

Transforming Mode and Adjusting Structure to Achieve Innovation-Driven Development and Sustainable Development

□为什么？发展条件变了，发展阶段变了

□老路走不下去：

- 环境不可持续
- 资源不可持续
- 产业不可持续
- 财政不可持续
- 发展不可持续

□Why? The conditions for development have changed and the stages of development have changed.

□The old road can't go down:

- The old road can't go down.
- Environmental unsustainability
- Unsustainable resources
- Industry unsustainable
- Fiscal unsustainability
- Unsustainable development

新能源革命不绿色低碳环保新要求

New Energy Revolution and New Requirements of Green Low Carbon Environment Protection

◆2006—2015年全球可再生能源年均增长5.7%，远高于化石能源1.5%的增速。2015年全球可再生能源发电量已占总发电量的23%，当年全球新增可再生能源发电装机已超过常规能源新增装机容量。2015年全球可再生能源投资达3289亿美元，远高于化石能源1300亿美元的投资额。预计未来15年，全球风电装机将增加3倍，太阳能发电装机将增加5倍，可再生能源越来越成为新增能源供应的主力能源，呈加速发展的趋势。

◆燃油车推出时间表越来越清晰

◆Renewable energy grew by 5.7% annually from 2006 to 2015, much faster than fossil energy by 1.5%. In 2015, the global renewable energy power generation has accounted for 23% of the total power generation. In that year, the installed capacity of new renewable energy power generation has exceeded that of conventional energy. In 2015, global investment in renewable energy amounted to \$328.9 billion, much higher than the \$130 billion investment in fossil energy. It is expected that in the next 15 years, global wind power installation will increase three times, solar power installation will increase five times, renewable energy is increasingly becoming the main source of new energy supply, showing a trend of accelerated development.

◆The launch schedule for fuel vehicles is becoming clearer and clearer.

化工与环保

Chemical Industry and Environmental Protection

➤ 化工是为美好生活“加油”的重要行业，也有人认为是安全环保事件频发的“麻烦制造者”

➤ 环保标准的提高恰恰为化工行业转型升级提供了推动力

➤ 不要将化工“妖魔化”“污名化”

➤ 不追求安全环保的化工很危险，做好安全环保的化工“很美好”

➤ Chemical industry is an important industry to "refuel" for a better life. Some people also think that it is a troublemaker with frequent safety and environmental protection incidents.

➤ The improvement of environmental protection standards provides impetus for the transformation and upgrading of chemical industry.

➤ Do not "demonize" or "stigmatize" chemical industry

➤ It is dangerous not to pursue safety and environmental protection in chemical industry. It is "very good" to do a good job of safety and environmental protection in chemical industry.

- 随着燃油车推出市场路线图的推出，炼油将越来越成为基础化学原料和大宗化学品的原料提供工厂
- 门捷列夫的预言将在元素周期表诞生150周年之际越来越成为现实
- 炼油行业也本身的激烈竞争也要求大型化，集成化，安全环保，工艺领先，成本控制成为自觉追求
- With the launch of the market roadmap for fuel vehicles, refineries will increasingly become the raw material suppliers of basic chemical raw materials and bulk chemicals.
- Mendeleev's prediction will become more and more realistic on the 150th anniversary of the birth of the periodic table of elements
- The fierce competition of oil refining industry itself also requires large-scale, integration, safety and environmental protection, leading technology, cost control to become a conscious pursuit.

炼油工艺

- 用劣质油品、环保工艺生产最高标准的产品将成为中国炼油的必然途径（如渣油加氢裂化等）
- “催化一响，黄金万两”的时代成为过去
- 全加氢，化工型将促成一系列新催化材料、新工艺的进步
- “Hydrogen Economy” 会结合石油、煤、天然气转化的整体优势最大化
- The production of the highest standard products by inferior oil products and environmental protection processes will become an inevitable way for China's oil refining (such as residue hydrocracking, etc.)
- The era of "catalysis, gold and gold" has become a thing of the past.
- Full hydrogenation and chemical model will promote the progress of a series of new catalytic materials and processes.
- "Hydrogen Economy" will maximize the overall advantages of oil, coal and natural gas conversion

化工 Chemical Industry

- 如果说炼油用“反应+分离”形容，那么化工必然要重视“结构（组成）+性能”
 - 高端化、定制化、市场导向、创新引领是化学品提供者必须做到的
 - 环保标准的提高也会促成系列高端专用化学品的市场需求
 - 固废资源化再生利用也会诞生新的朝阳行业
-
- If refining is described as "reaction + separation", chemical industry must pay attention to "structure (composition) + performance".
 - High-end, customized, market-oriented and innovation-oriented are what chemical suppliers must do.
 - The improvement of environmental standards will also promote the market demand for a series of high-end specialty chemicals.
 - Solid waste recycling and reuse will also produce a new sunrise industry

分子炼油、原子经济、绿色化学技术进步方兴未艾，同时促进工艺技术和产品更加环保
互联网+，智能+，智能工厂，AI技术等等新技术革命也将成为传统行业新旧动能转换的“加速器”
大型新型炼化基地的频频亮相使得中国的炼化行业成为全球瞩目的焦点和“竞技场”

Molecular Refining, Atomic Economy and Green Chemistry Technologies are progressing in the ascendant, and at the same time, process technology and products will be promoted to be more environmentally friendly.

Internet +, intelligent +, intelligent factory, AI technology and so on will also become a new accelerator for the transformation of new and old kinetic energy in traditional industries.

The frequent appearance of large-scale new refining and chemical bases has made China's refining and chemical industry the focus of global attention and the "arena"

《巴黎协定》确立了全球控制温升2°C以内并努力争取1.5°C的目标，全球温室气体排放到2030年需从2010年500亿吨二氧化碳当量下降到400亿吨，并到本世纪下半叶实现净零排放。对能源体系而言，尽管全球变革趋势加速，2016—2030未来15年与2000—2015前15年相比，GDP的二氧化碳排放强度年下降率将加倍，二氧化碳排放增长率也将由2%以上下降为1%以下，但到2030年全球二氧化碳排放总量仍将比2010年增长约20%，与实现全球控制温升2°C目标存在巨大减排缺口。全球应对气候变化的紧迫目标和形势，将**倒逼**更大力度的能源变革。

The Paris Accord has set the goal of controlling temperature rise within 2 degrees Celsius globally and striving for 1.5 degrees Celsius. Global greenhouse gas emissions need to be reduced from 50 billion tons of carbon dioxide equivalent in 2010 to 40 billion tons by 2030, and net zero emissions will be achieved by the second half of this century. For the energy system, despite the accelerated trend of global change, the annual decline rate of carbon dioxide emission intensity of GDP will double in the next 15 years of 2016-2030 compared with the first 15 years of 2000-2015, and the growth rate of carbon dioxide emissions will also drop from more than 2% to less than 1%, but the total global carbon dioxide emissions will still increase by about 20% in 2030 compared with 2010. There is a huge gap in emission reduction to achieve the goal of global control of temperature rise of 2 degrees Celsius. The urgent goal and situation of global response to climate change will force greater energy change.

➤ 欧盟提出2030年能源总消费量减少30%，可再生能源占比达27%，电力的50%来自可再生能源。德国提出2050年能源消费量减少50%，可再生能源在总耗能中占比达60%，发电量占比达80%。美国能源部计划光伏发电到2030年占总电量的20%，2050年前达40%。世界大国在能源体系转型和能源替代变革中将发挥引领性作用。

➤ 燃油汽车退意义出时间表的意义

➤ The EU proposes a 30% reduction in total energy consumption by 2030, with 27% of renewable energy and 50% of electricity coming from renewable energy. Germany proposes to reduce energy consumption by 50% by 2050, with renewable energy accounting for 60% of total energy consumption and electricity generation accounting for 80%. The U.S. Department of Energy plans photovoltaic power generation to account for 20% of total electricity by 2030 and 40% by 2050. The world's major powers will play a leading role in the transformation of energy system and energy substitution.

➤ Significance of Exit Schedule for Fuel Vehicles

当前经济社会发展也面临日趋强化的资源环境制约，随经济发展能源消费的持续增长不仅使石油天然气进口依存度持续增加，能源安全面临新的挑战，而且煤炭、石油等化石能源消费过程中所产生的二氧化硫、氮氧化物、烟尘等常规污染物排放已严重超出环境的承载能力和自净化能力，造成**资源紧缺、环境污染、生态恶化**的严峻形势，也是形成雾霾天气的主要原因。

At present, the economic and social development is also facing increasingly intensified resource and environmental constraints. With the sustained growth of energy consumption in economic development, not only the dependence on oil and gas imports continues to increase, but also the new challenges to energy security. In addition, sulfur dioxide, nitrogen oxides, smoke and dust generated in the process of coal, oil and other fossil energy consumption are also increasing. The discharge of conventional pollutants has seriously exceeded the carrying capacity and self-purification capacity of the environment, resulting in a severe situation of **resource shortage, environmental pollution and ecological deterioration**, which is also the main reason for the formation of haze weather.

▶要促进大气、水资源、土壤等环境质量全面好转，除严格排放标准和加强治理措施外，更重要的控制和减少化石能源消费量，从源头上减少污染物排放。

▶因此推动能源生产和消费革命，节约能源，改善能源结构，建立高效、安全、清洁、低碳的能源供应体系和消费体系，既是国内节约资源、保护环境的内在需求，也是应对气候变化减排二氧化碳的关键对策，两者具有显著的协同效应，是实现国内可持续发展与保护地球生态安全相协调统一的战略选择。

▶In order to improve the environmental quality of atmosphere, water resources and soil in an all-round way, besides strict emission standards and strengthening control measures, it is more important to control and reduce fossil energy consumption and reduce pollutant emissions from sources.

▶Therefore, promoting the revolution of energy production and consumption, saving energy, improving energy structure, and establishing an efficient, safe, clean and low-carbon energy supply and consumption system are not only the internal needs of saving resources and protecting the environment, but also the key countermeasures to cope with climate change and reduce carbon dioxide emissions. The same effect is a strategic choice to achieve the coordination and unification of sustainable development and protection of the earth's ecological security.

实现绿色低碳发展迫在眉睫

It is imminent to realize green and low-carbon development

➤以低碳环保为特征的工业、建筑和交通体系。随着能源资源和环境硬约束更趋强化，依靠大量消耗不可再生资源支撑经济增长的局面难以持续，迫切要求降低能源资源消耗和排放强度。

➤推动包括科技创新和制度创新在内的全面创新，打造有利于绿色发展的“硬技术”和“软环境”。加速淘汰“三高”产业，发展绿色、低碳、环保的新产业、新业态，实现高效率、高质量增长基础上的绿色发展。

➤Industrial, construction and transportation systems characterized by low-carbon environmental protection. With the intensification of the hard constraints on energy resources and environment, it is difficult to sustain economic growth by relying on a large amount of non-renewable resources consumption. It is urgent to reduce the intensity of energy resources consumption and emissions.

➤Promote all-round innovation, including scientific and technological innovation and institutional innovation, and create a "hard technology" and "soft environment" conducive to green development. We will accelerate the elimination of "three high" industries, develop new industries and new formats of green, low-carbon and environmental protection, and achieve green development based on high-efficiency and high-quality growth.

- 发展可再生能源和清洁能源技术、绿色节能技术，调整能源供给结构，实现绿色减排目标。
- 发展绿色制造。促进绿色环保节能的生产工艺和装备、节能环保产品等生产和推广。
- 发展建筑节能。
- 发展废弃物资源化利用和污染治理技术。
- 更重要的是营造鼓励绿色创新的体制机制和政策。

- Develop renewable energy and clean energy technologies, green energy-saving technologies, adjust the energy supply structure, and achieve the goal of green emission reduction.
- Develop **green manufacturing**. Promote the production and promotion of green environmental protection and energy-saving production technology and equipment, energy-saving and environmental protection products, etc.
- Develop building energy conservation.
- Develop **waste resource utilization and pollution control technology**.
- More importantly, we should create **institutional mechanisms and policies to encourage green innovation**.

绿色化学简介

Green Chemistry

环境无害化学

Environmentally
sound chemistry



环境友好化学

Environmentally
Friendly Chemistry



清洁化学

Clean Chemistry

从源头消除污染的途径

新设计化学合成方法和化工产品来根除污染源

Ways to Eliminate Pollution from Source

New design of chemical synthesis methods and
chemical products to eradicate pollution sources

绿色化学的兴起

The Rise of Green Chemistry

- 环境保护的推动 **Promotion of Environmental Protection**
- 合理利用资源 **Rational Utilization of Resources**
- 降低成本 **Cost reduction**
 - 环境监测费用 **Environmental monitoring costs**
 - 废物处理费用（欧盟领先） **Waste Disposal Costs (EU Leading)**
 - 人身保健费用 **Personal health care costs**
 - 社区安全保险费用等 **Community Safety Insurance Expenses, etc.**

不同工业部门生产中的废物排放量

Waste Emissions from Production in Different Industrial Sectors

工业部门 Industrial sector	每吨产品排放的废物 (吨/吨) Waste discharged per ton of product (ton/ton)
炼油 Oil refining	~0.1
大宗化学品 Bulk chemicals	1~5
精细化工 Fine chemical industry	5~20
制药 Pharmaceutical	25~100

制药、精细化工——更需开发原子经济反应

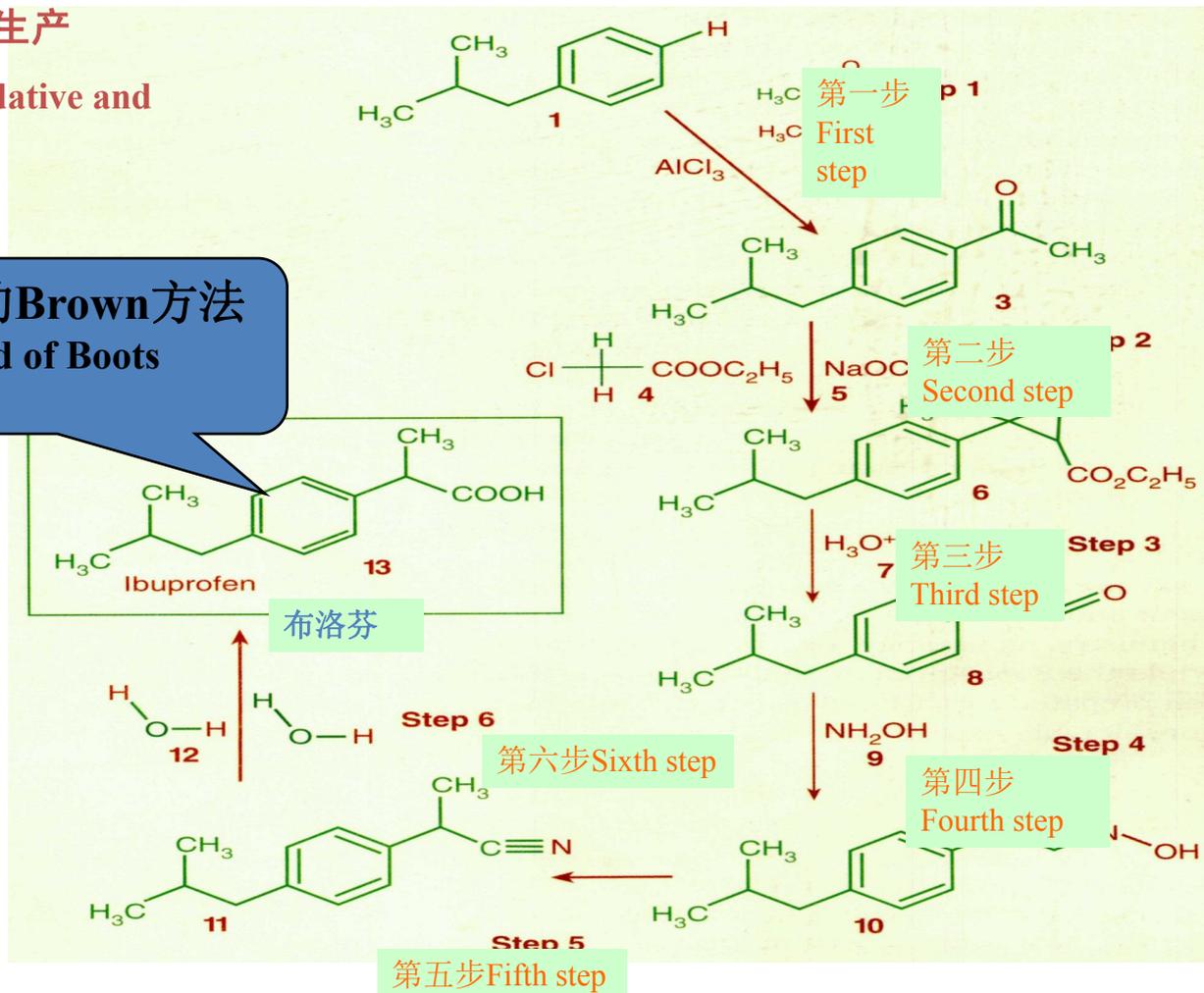
Pharmaceutical, Fine Chemical Industry—More Need to Develop Atomic Economic Reaction

布洛芬—镇静、止痛药的生产

Ibuprofen-Production of Sedative and Analgesic Drugs

Boots公司的Brown方法
Brown Method of Boots Company

原子经济性
Atomic economy
~40%



BHC公司新发明的
绿色方法
New Green Method
Invented by BHC
Company

原子经济性Atomic economy

~99%

(包括醋酸)

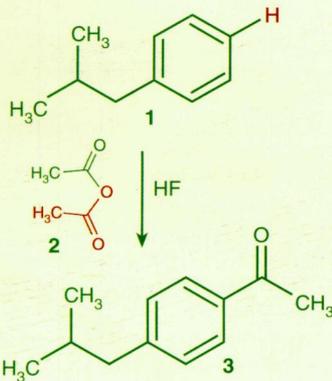
(Including acetic acid)

获1997年美国总统“绿色化学挑战奖”

The 1997 US President's Green Chemistry Challenge Award

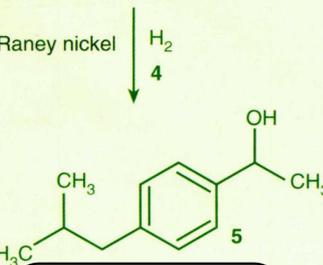
第一步

Step 1



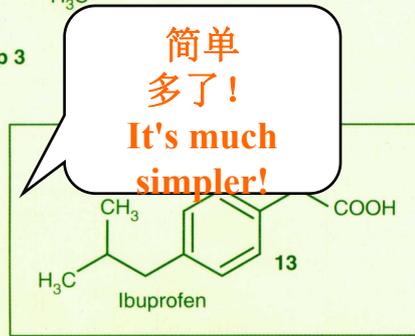
第二步

Step 2



第三步

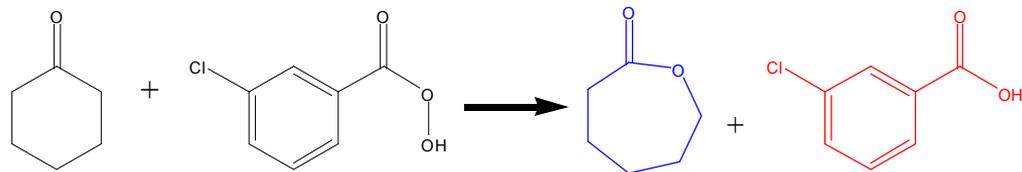
Step 3



Baeyer-Villiger 反应——用于生产医药、塑料添加剂

Baeyer-Villiger reaction— Used in the production of pharmaceutical and plastic additives

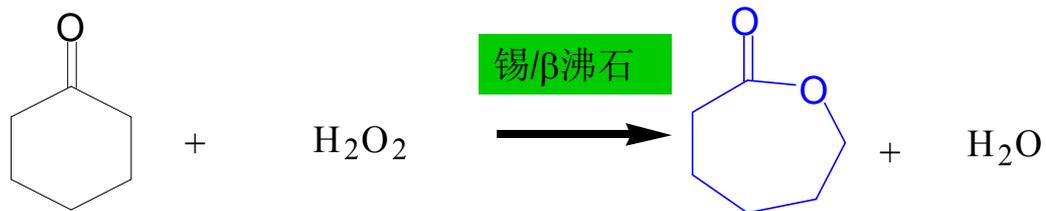
➤ 传统工艺 Traditional technology



3-氯过苯甲酸氧化剂，原子经济性42%，产生3-氯苯甲酸废物

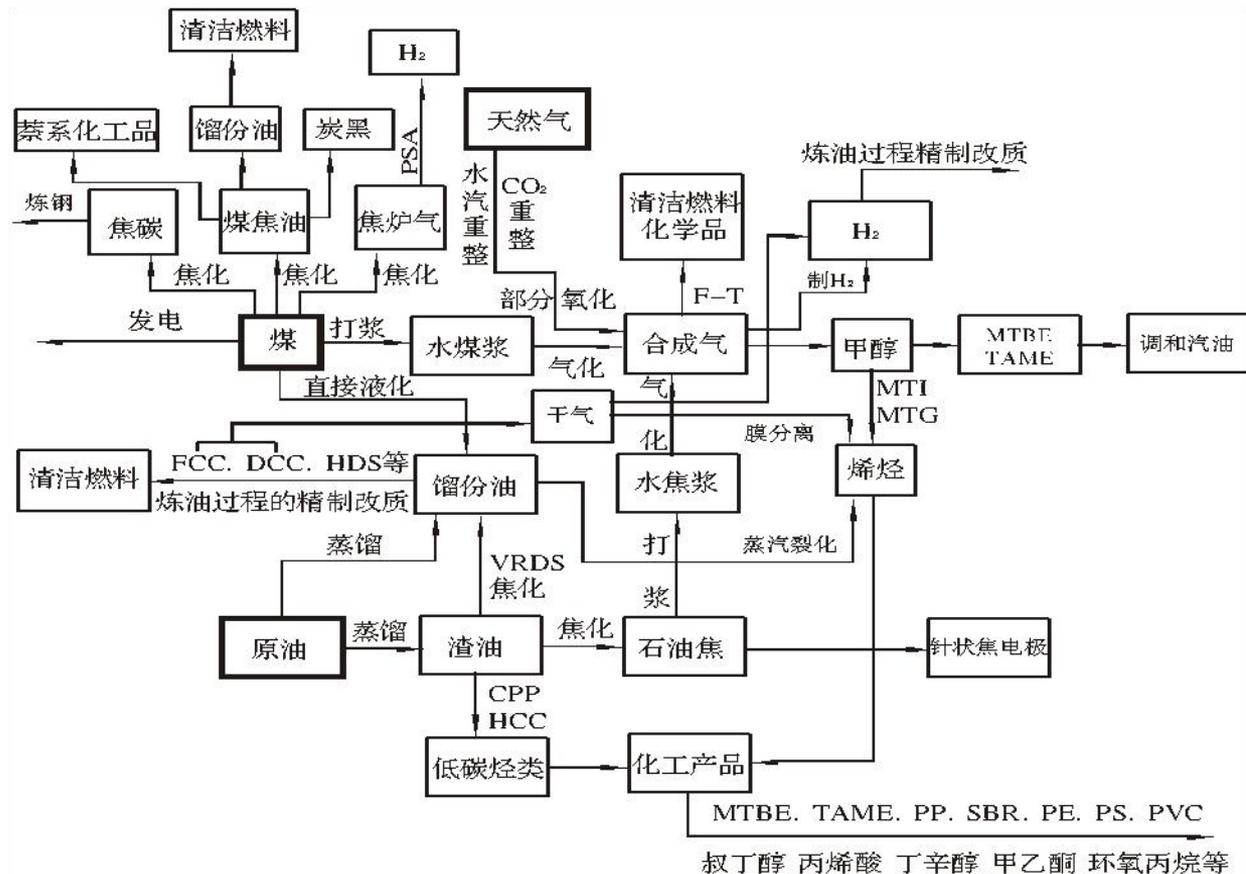
3-chloroperoxybenzoic acid oxidant, atomic economy 42%, producing 3-chlorobenzoic acid waste

➤ 绿色工艺 Green technology



负载锡的β沸石催化剂，过氧化氢氧化剂，原子经济性86%，副产物只有水

Tin-loaded β zeolite catalyst, hydrogen peroxide oxidant, atomic economy 86%, by-product only water



能源-化工协调发展示意图

达建文：2003，石油化工技术经济，第七期

Da Jianwen: 2003, Petrochemical Technology and Economy, the 7th Phase

绿色化学

Green Chemistry

- 从科学观点看——化学科学基础的创新
 - 从环境观点看——从源头上消除污染
 - 从经济观点看——合理利用资源和能源，降低生产成本
- 符合经济和社会可持续发展的要求

From the Scientific Point of View: Innovation of Chemical Science Foundation

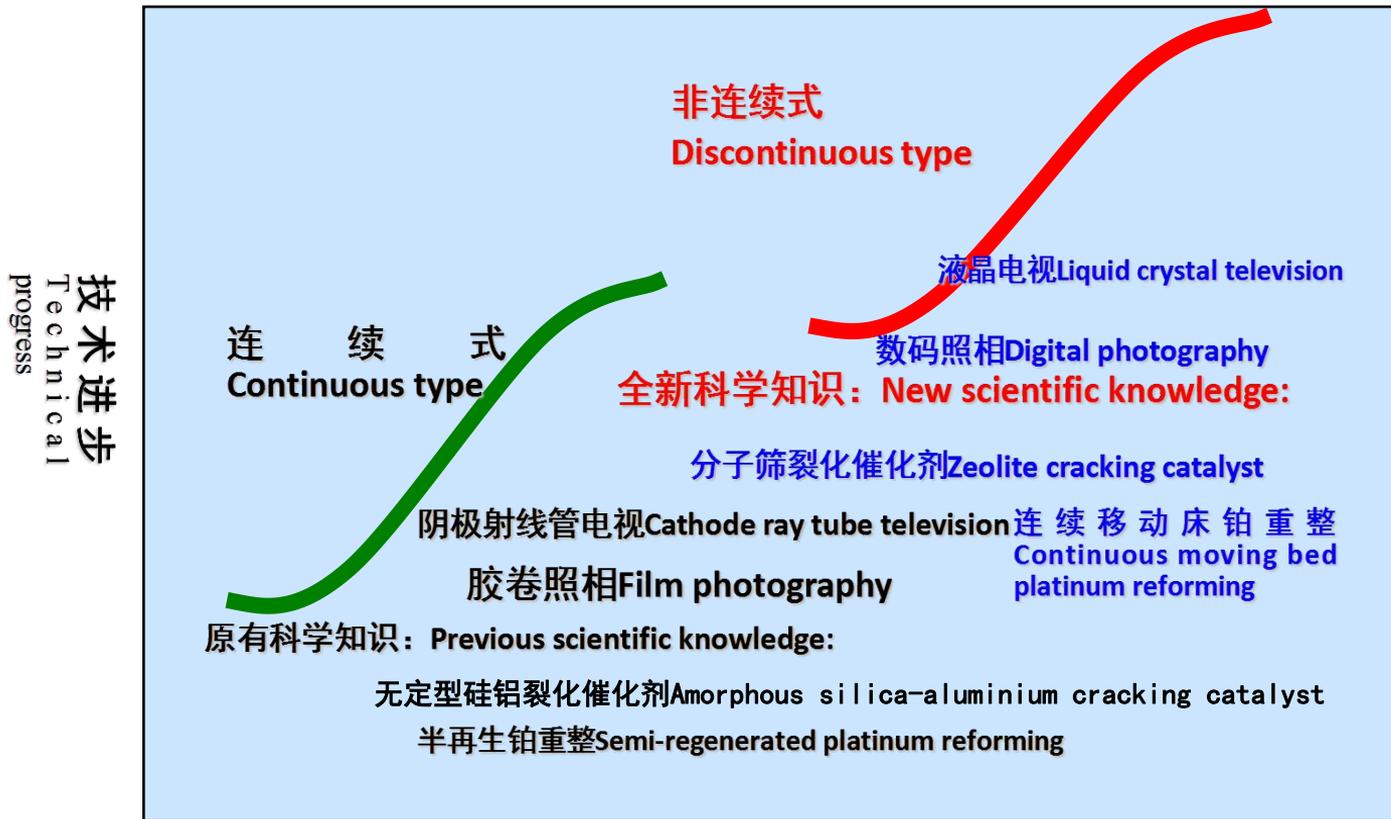
From the Environmental Perspective - Eliminating Pollution from the Source

From an economic point of view - rational use of resources and energy, reduce production costs

—— To meet the requirements of sustainable economic and social development

技术进步S型曲线

S-shaped curve of technological progress



投入的人力、物力 Human and material resources invested

联想
Information

创新
Association

信息
Innovation

01

新催化材料
New Catalytic Materials

02

新反应工程
New Reaction Engineering

03

新反应或反应新应用
New reactions or new applications of reactions

04

其他学科的信息
Information on other disciplines



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第十三届全国政协委员

Member of the 13th CPPCC National Committee

第五届中国经济社会理事会理事

Member of the 5th Economic and Social Council of China

中国石化集团公司首批创新领军人才

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谢谢



Thank you for your attention.

