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Synfuels China

OUR EXPERTISE ENERGY IN FUTURE

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OUR EXPERTISE ENERGY IN FUTURE

Message From The General Manager

Synfuels China Co. Ltd. is a technology innovator and provider, specialized in the research and development of Coal-To-Liquid (CTL) technologies and corresponding engineering support. We are committed to the development of CTL technologies with independent intellectual property rights, and the exploration of a new model for the development and industrialization of proprietary technologies, in order to secure the demand of national energy.

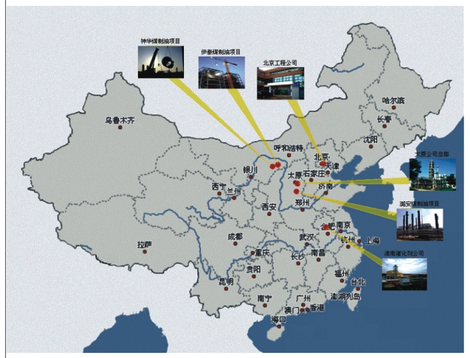
Synfuels China has been dedicating to the development of a technology and management system for the industrialization of new technologies. This system is based on the scientific research and technological innovation, and supported by the design and production of catalyst and engineering design. Synfuels China has carried out extensive R&D on next generation Fischer-Tropsch Synthesis (FTS) core technologies as well as the innovation and optimization of technology integration. A unique structure of technology development has been established in Synfuels China. It covers from basic research, laboratory-scale investigation, engineering design, and the commissioning of pilot and industrial-scale plants. Above all, a high-quality and experienced engineering and technology team has been formed, capable of problem-solving and supporting the industrialization of our CTL technologies. Nowadays, Synfuels China has evolved as a major provider of CTL technologies. Our solid foundation of scientific research and development will meet the national demand on CTL technologies for the next 10 to 20 years.

We pursue the spirit of "honesty, innovation, solidarity and excellence", and our philosophy is "Our Expertise, Energy in future". With the rapid development of Chinese economy and the recovery of world economy after the latest financial crisis, the development of local and international economy will be bottlenecked by the limited supply of petroleum. As an alternative fuel approach, CTL is important for the national energy security during the transition period from fossil fuel to biomass fuel. We are ready and will make more contributions to the sustainable development of Chinese and world economy.

General Manager: Yongwang Li

OUR EXPERTISE ENERGY IN FUTURE

About us



Synfuels China was established in 2006 by Chinese Academy of Sciences and several other companies on the basis of previous research achievements and a R&D team. It is the only scientific R&D entity in China, which is specialized in the basic research and development of CTL technology, engineering design, design and production of catalyst, and technical support for industrialization. Its establishment symbols a new model for R&D innovation and exploitation, and will make critical contribution to the rapid development and industrialization of our national CTL technologies.

After many years of development, Synfuels China owns the low and high temperature slurry bed FTS technologies with independent intellectual property rights, including more than 90 patents. A high-quality R&D team has been formed with more than 80 research professors, associate professors, and PhDs. Their expertise covers quantum chemistry, chemical engineering, catalysis, chemical reaction kinetics, fluid dynamics, chemical analysis, process simulation, chemical process, and equipment and instrument, etc. There are more than 400 scientific research, engineering design, and managerial personnel in Synfuels China.

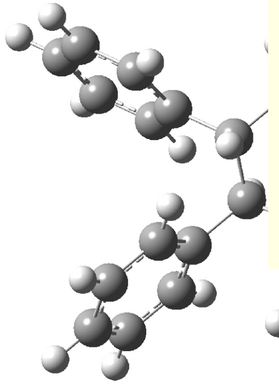
About us

Synfuels China

Synfuels China aims to develop advanced CTL technologies with self-owned intellectual property rights, and serve the national energy strategy, and promote clean and efficient coal utilization technologies. To implement these objectives, Synfuels China has established three sub-companies-Synfuels Research and Development Center, Synfuels China Engineering Co. Ltd., and Synfuels China Catalyst Co. Ltd. Synfuels China is also the major shareholders of several domestic large-scale chemical industrial equipment manufacturing companies.

With the unique integrated structure, Synfuels China is able to deliver several original and advanced technologies on industrial scale to our potential customers, such as the CTL technologies, the stepwise coal liquefaction technology, the γ-butyrolactone, tetrahydrfuran, propanediol fine chemicals production technologies, etc.

Key Technologies



Synfuels China

During the 10th five-year plan, Synfuels China undertook "The technological development of coal-based synthetic liquid in an industrial-scale slurry bed " supported by "The National 863 Plan", one of the Knowledge Innovation Key Projects of the Chinese Academy of Sciences. Systematic research and development on the indirect coal liquefaction FTS in an industrial scale slurry bed was carried out. An advanced low temperature synthetic fuel process in a slurry bed was successfully developed, including slurry-bed reactor, FTS iron-based catalyst, and systematic product workup technologies. Its technical parameters outperformed those of equivalent international technologies at that time.

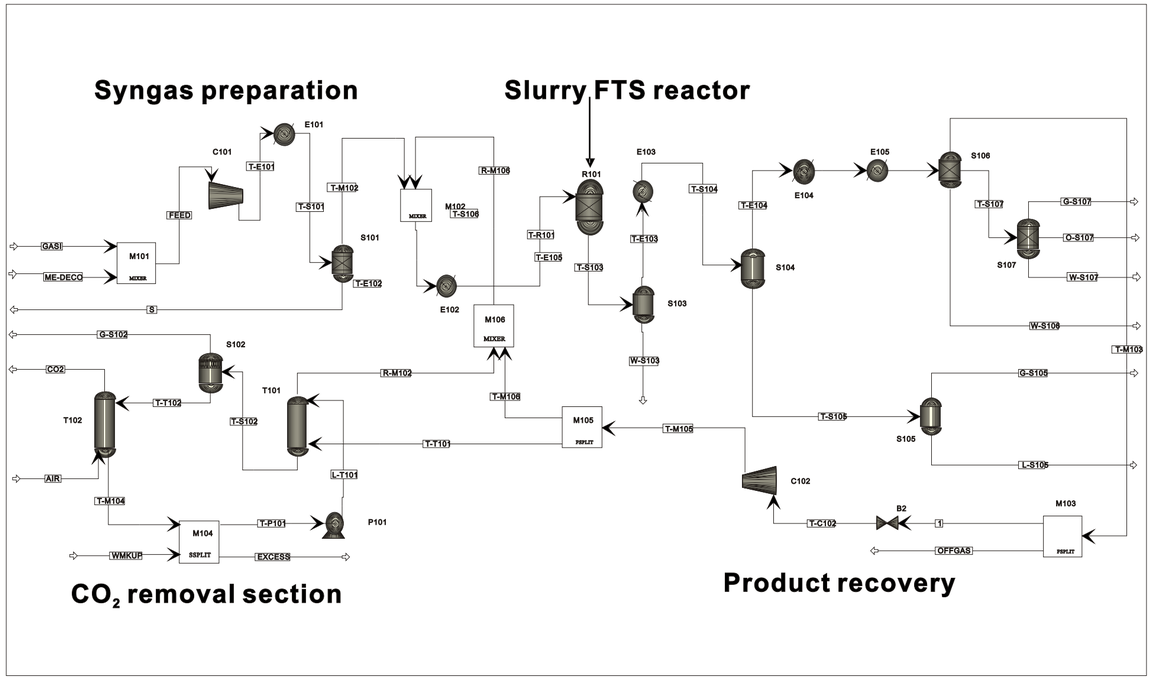
During the 11th five-year plan, Synfuels China was granted a major fund under the "The National 863 Plan-Energy Field" for the development of 10kt/a to 1Mt/a synthetic fuel technology. An original High-Temperature Slurry-bed F-T Synthesis Process (HTSFTP) has been developed successfully. Compared to the low temperature technology, the HTSFTP has higher oil productivity and much higher catalyst yield (0.8-1.0g/g cat/h) as well as improved steam quality (25-30bar). The overall energy efficiency has been improved from 40% to 45%.

Synfuels China has applied for 93 patents on low and high temperature FTS processes, and 55 patents have been approved. Synfuels China also owns one software copy right for the FTS process. A proprietary patent system for the indirect coal liquefaction technologies has been formed in Synfuels China. The HTSFTP technology has been successfully applied in Shenhua 180kt/a coal-based synfuel demonstration plant and another two 160kt/a demonstration plants at Lu'an in Shanxi province and Yitai in Inner Mongolia. Synfuels China is ready for the construction of 3Mt/a coal-based synfuel plants with the support of our talented and experienced engineering team.

Synfuels China

OUR EXPERTISE ENERGY IN FUTURE

Technology Philosophy



To improve the overall energy efficiency of HTSFTP, Synfuels China has carried out extensive R&D on the integration schemes of low temperature coal pyrolysis, CTL, and gas turbine power generation, etc. With the easy adaptability of the technology to biomass, Synfuels China is also active in promoting the application of FTS technology with biomass for the smooth transition of feedstock from fossil fuel to biomass in the future.

Synfuels China has focused on the following aspects during its R&D on CTL technologies:

Extensive basic research such as quantum chemistry and catalysis, which has contributed to the innovation and improvement of HTSFTP catalysts.

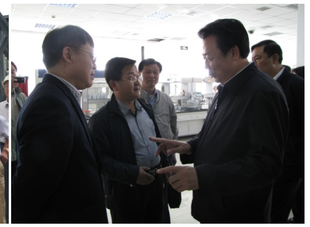
Detailed process modeling as an important tool for the integration and optimization of coal conversion processes in indirect coal liquefaction.

Engineering research on the development of unit operation facilities such as fluid dynamics, reactor structure including internal components, material engineering, and structure optimization of large-scale heat exchangers and separators.

R&D on oil product workup technologies.

Establishing an integrated engineering system, which includes a basic research center for the laboratory-scale investigation, an engineering design team, joined ventures with large-scale manufacturing companies for the manufacture of core CTL industrial equipments, and industrialization research of CTL technologies.

Industrialization Support



In order to promote the development and industrialization of CTL technologies in China and meet the requirement for CTL technology support as well, Synfuels China has set up three functional technology platforms–the indirect CTL industrialization technology development and engineering center, the CTL technology validation and product evaluation / analysis center, and the indirect CTL technology exchange and cooperation platform. An efficient supporting system for the development and industrialization of technologies has been formed by the seamless integration between the Synfuels China R&D Center (fundamental research in engineering technology), Synfuels China Engineering Co. Ltd. (engineering design and project contract), Synfuels China Catalyst Co. Ltd. (catalyst production), and Jinzhou (Inner Mongolia) Chemical Engineering Machinery Co. Ltd. (processing and manufacturing large special equipments). Meanwhile, Synfuels China is also carrying out R&D on relevant derivative technologies， and training senior researchers and technicians for relevant industry societies.

Technology Development

Basic Research

The aim of basic research in Synfuels China is to provide theoretical foundation for catalyst design, basic research data, process models and computer programs for engineering design.

$$k_{7M}K_4K_6K_3'\frac{P_{H_2}^2P_{CO}}{P_{H_2O}}$$

$$R_{CH_4}=\frac{}{\left[1+\sqrt{K_4P_{H_2}}+K_1P_{CO}+K_3'\frac{P_{H_2}^2P_{CO}}{P_{H_2O}}+K_1K_2P_{CO}P_{H_2}+K_6K_4^{0.5}K_3'\frac{P_{H_2}^{2.5}P_{CO}}{P_{H_2O}}+K_3'\frac{P_{H_2}^2P_{CO}}{P_{H_2O}}(1+K_6\sqrt{K_4P_{H_2}})\sum_{i=2}^{n}\prod_{j=2}^{i}(\alpha_j)\right]^2}$$

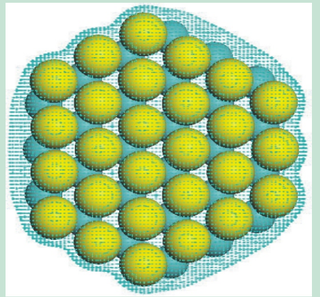
R&D on Catalyst Design and Production

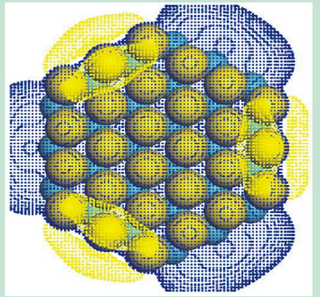
Two series of iron-based catalysts have been developed successfully and put into production. A 1500t/a CTL catalyst plant was built in 2008, and will be expanded up to 5000t/a on the second phase. R&D on new FTS catalyst and related basic studies are also in progress.

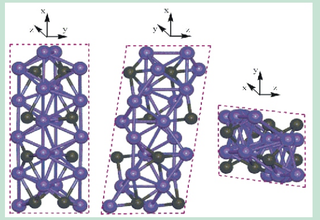
$$R_{C_nH_{2n+2}}=\frac{}{\left[1+\sqrt{K_4P_{H_2}}+K_1P_{CO}+K_3'\frac{P_{H_2}^2P_{CO}}{P_{H_2O}}+K_1K_2P_{CO}P_{H_2}+K_6K_4^{0.5}K_3'\frac{P_{H_2}^{2.5}P_{CO}}{P_{H_2O}}+K_3'\frac{P_{H_2}^2P_{CO}}{P_{H_2O}}(1+K_6\sqrt{K_4P_{H_2}})\sum_{i=2}^{n}\prod_{j=2}^{i}(\alpha_j)\right]^2}$$

$$R_{C_nH_{2n}}=\frac{k_8^+(1-\beta_n)K_3'P_{H_2}^2P_{CO}/P_{H_2O}\prod_{j=2}^{n}\alpha_j}{1+\sqrt{K_4P_{H_2}}+K_1P_{CO}+K_3'\frac{P_{H_2}^2P_{CO}}{P_{H_2O}}+K_1K_2P_{CO}P_{H_2}+K_6K_4^{0.5}K_3'\frac{P_{H_2}^{2.5}P_{CO}}{P_{H_2O}}+K_3'\frac{P_{H_2}^2P_{CO}}{P_{H_2O}}(1+K_6\sqrt{K_4P_{H_2}})\sum_{i=2}^{n}\prod_{j=2}^{i}(\alpha_j)}$$

$$R_{CO_2}=\frac{k_\nu(P_{CO}P_{H_2O}/P_{H_2}^{0.5}-P_{CO_2}P_{H_2}^{0.5}/K_p)}{1+K_\nu P_{CO}P_{H_2O}/P_{H_2}^{0.5}}$$







Synfuels China

Technology Development

Study on oil product workup technologies

Various oil product workup catalysts and technologies have been investigated. Synfuels China is now capable of coming up with required product scheme by adjusting and optimizing of existing CTL product schemes.

Study of analysis technologies

Procedures for the analysis of critical components in oil product and industrial standards for CTL have been established to facilitate the detailed analysis of F–T oil products.

Technology Development

R&D on engineering design and equipment manufacture

Allied with domestic large equipment manufacture enterprises, Synfuels China has established a R&D platform for the engineering design and equipment manufacture in the indirect coal liquefaction industry in China.

Synfuels China

Technology Development

Stepwise liquefaction technology

An original stepwise liquefaction technology has been proposed and investigated by Synfuels China on laboratory scale. It integrates the low temperature coal pyrolysis, modern gasification technology, and advanced slurry bed FTS process. With the new stepwise liquefaction technology, the overall energy efficiency of CTL could be improved from 38–43% to 50–55%. A 1t/d pilot plant has been built and is under commissioning in 2010.

Research on fine chemical technologies

R&D on fine chemicals such as γ–butyrolactone, tetrahydrofuran, and propanediol have been carried out in Synfuels China. A Second Place Prize of National Scientific and Technical Inventions has been awarded to our Coupled Reaction Process for the Production of γ–butyrolactone and 2–methyl furan. A 1kt/a γ–butyrolactone unit was built and put into service successfully in 2004, and has been expanded up to 5kt/a in 2008.

R&D Team

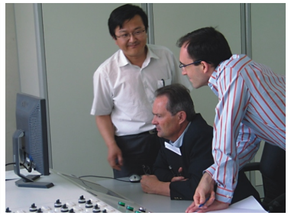
Synfuels China

Human resources are always regarded as the most important asset in Synfuels China. Under the direction of Prof. Yongwang Li, General Manager of Synfuels China and Chief Scientist of National Indirect Coal Liquefaction Engineering Laboratory, a powerful R&D team has been formed, which includes more than 80 research professors, associate professors, and PhDs. The high standard of this team has been recognized internationally in the field of indirect coal liquefaction, and many awards have been awarded to Synfuels China, such as the Innovation Prize of China International Industry Exhibition Fair, the Outstanding Science and Technology Achievement Prize of the Chinese Academy of Sciences, the National Scientific and Technical Key Task Certificate, the Prize of Science and Technology Achievement of Shanxi Province, and the Technical Innovation Demonstration Enterprise of Chinese Chemical Industry, etc.

International Exchange and Cooperation

Synfuels China is actively involved in the international exchange and cooperation with major international institutes and companies on R&D and industrialization of CTL technologies, which contributes a lot to the rapid expansion and technology development of Synfuels China.

Synfuels China hosts academic seminars and symposiums on CTL technologies periodically. The Annual International Symposium on the Global CTL Technical Development is organized by Synfuels China and held in China. Famous CTL experts and scholars as well as major foreign companies have been invited to attend the conferences, exchange ideas and introduce new technologies. This is useful for the growth of Synfuels China's young R&D team. Moreover, an exchange program has been established, and scholarships are provided for qualified international scholars.



Social Responsibilities

Synfuels China

While undertaking R&D on new technologies and making contributions to Chinese economy, Synfuels China also actively involves in various charity activities to reward the society for their support, including donation to those suffering from Wenchuan earthquake and other natural disasters, financial support for schools in underdeveloped areas, etc. In 2009, Synfuels China donated to the Science Teacher Training Program organized by Green and Shine Foundation.

To encourage talented researchers to make more contributions for the innovation of clean coal technologies, Synfuels China set up an Excellent Research Prize in Shanxi Institute of Coal Chemistry, Chinese Academy of Sciences in 2007. It has ignited huge enthusiasm among young researchers to join the R&D programs on clean coal technologies. Synfuels China will broaden the scope of this fund to many other relevant institutes and universities in China in the near future.

History of Synfuels China

1980-1993	• R&D on fixed-bed technology for the indirect coal liquefaction to gasoline and diesel.
1997-1999	• R&D on the FTS slurry-bed technology and related catalyst.
2001	• Constructed a 1kt/a CTL industrial pilot plant, supported by the 863 Project of the Ministry of Science and Technology as well as the 10th five-year Key Project of Chinese Academy of Sciences.
2002	• The Industrial Pilot plant was commissioned successfully on the first time test, producing qualified FTS products.
2004	• The board of synfuels center was formed.
2005	• Passed the acceptance test of 863 Indirect CTL Technology.
2006	• Passed the acceptance test of "Industrialization Technology of Coal-To-Liquid in a Slurry bed", one of the Knowledge Innovation Key Projects of Chinese Academy of Science. • Synfuels China was established • Synfuels China was awarded the Outstanding Science and Technology Achievement Prize of the Chinese Academy of Sciences. • Construction of 160kt/a Demonstration Plant started.
2007	• Original high-temperature slurry bed CTL technology was developed successfully.
2008	• National Indirect Coal Liquefaction Engineering Laboratory was approved. • Construction of Synfuels China's R&D Center in Beijing was started.
2009	• Two 160kt/a High Temperature Slurry bed FT Process (HTSFTP) demonstration plants were constructed and commissioned successfully at Yitai in Inner Mongolia and Lu'an in Shanxi Province, with independent intellectual property rights. • A 400t/a γ-butyrolactone unit was commissioned successfully and put into service
2010	• Technically ready for the construction of a 3Mt/a HTSFTP industrial-scale plant. • Australia Office of Synfuels China was established in 2010.