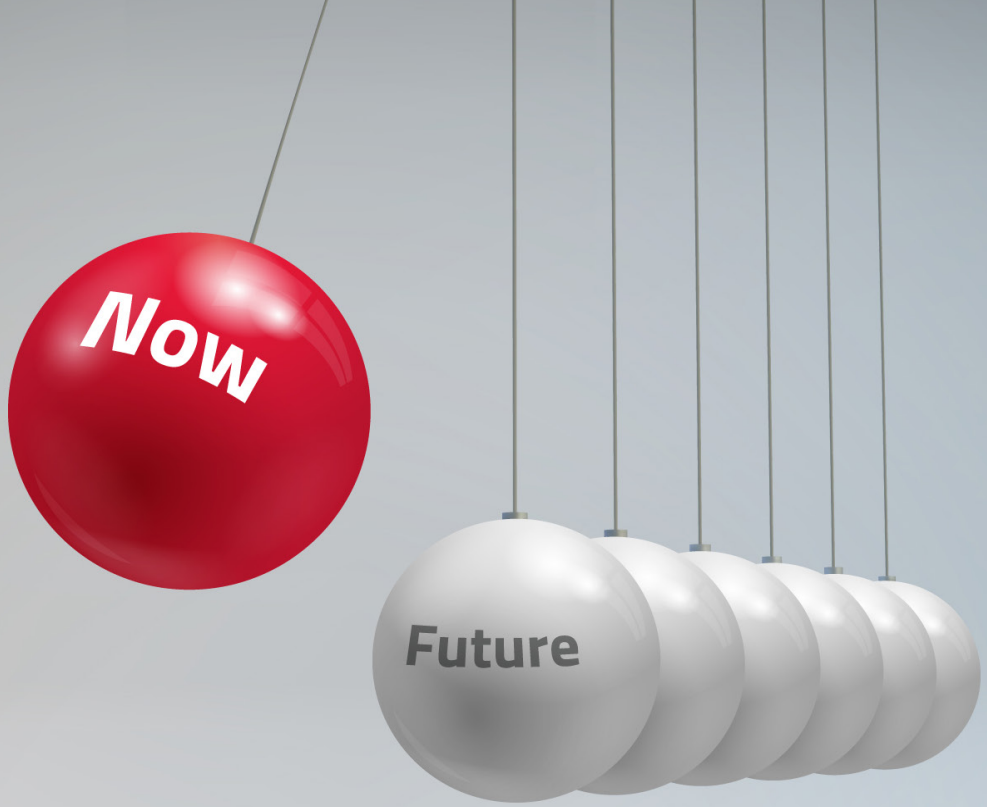


ChemEssen

Now and Future

Company Profile

ChemEssen

WHO WE ARE

OUR DNA

WE EXPLORE A SPACE EVEN BIGGER THAN THE UNIVERESE: CHEMICAL SPACE

Tens of thousands (10^4) of chemicals are currently being used in human life. About one hundred million (10^8) chemicals have been invented so far in chemical history. How many more are possible? In theory, the possible number spans from 10^{60} to 10^{200} (called chemical space), which is greater than the number of particles in the universe.

We have spent over a decade probing the chemical space to unlock new possibilities for industries like pharmaceuticals and material science. We are now able to scan and analyze billions of chemicals automatically at the quantum level. All the core technologies we developed are originated from this fundamental understanding at the quantum level. During the past ten years, we have been granted 41 technology patents, two trademark rights for more than 30 countries, three national R&D projects of over $3 million USD, the 2014 Best Korean Patent award, and more than $14 million US dollar investment. Many special information technologies were developed as well, which resulted in launching four commercial online services.

We started in April 2006 with three people. Now we have 40 expert staff including professional scientists, engineers, chemists, and software developers.

Company **History**

2006

Founded with the visions of developing chemical related technologies and products based on the fundamental understandings of the substances at the level of quantum chemistry.
Dr. Tae-Yun Park , the founder of ChemEssen confirmed this feasibility during his Ph. D. works.

By combining chemical science with information technologies, ChemEssen's goal was to challenge the chemical space comprising infinitive number of chemicals and contribute to the chemical industries using the revolutionary products.

Initiated the core technology developments related to quantum chemical analysis.

Attracted a domestic direct investment.

2007

Completed the construction of ChemEssen's own computing center which contains 200 computer CPU cores.

Initiated the core technology developments related to auto generation of chemicals, mathematical modeling, scientific computations, parallel processing, auto processing of chemicals, networking & communication, and software developments.
Established the company-affiliated research institute.

2008

Upgraded the computing center by adding additional 2,000 computer CPU cores.

Completed the core technology developments related to quantum chemical analysis, auto processing of chemicals, parallel processing, and auto processing of chemicals.

Initiated the core technology developments related to the special database for scientific chemical information and artificial intelligence based on the artificial neural network approach.

Awarded 1st government grant for an innovative technology development project granted by Small and Medium Business Administration.

Certified for Venture Business by Small and Medium Business Administration.

Completed the installation of the testbed servers for commercial services.

2009

Completed the quantum chemical analysis based process for 1 million chemical compounds.

Initiated the core technology developments related to user interface & web service and 3D image processing & animation of chemical compounds.

Awarded 2nd government grant for an innovative technology development project granted by Small and Medium Business Administration.

2010

Launched the beta version of Mol-Instincts database with the PC client software for user's side.

Moved the computing center to an IDC (Internet Data Center) and upgraded by adding 5 additional high-performance servers equipped with GPU (Graphics Processing Unit).

Completed the core technology developments related to special database construction and 3D image processing & animation of chemical compounds.

2011

Completed the developments of all the property prediction modules.

Upgraded the computing center by adding additional high-performance servers with 312 CPU cores.

Initiated the core technology developments related to server infra & cloud system.

Completed the core technology developments related to mathematical modeling, artificial intelligence, scientific computations, and networking & communication.

Applied 41 technology based patents.

Attracted 1st foreign direct investment.

2012

Registered 2 trade marks for more than 30 countries around the world.

Initiated the core technology developments related to embedded system.

Completed the core technology developments related to web and PC software.

2013

Launched the commercial version of Mol-Instincts database with the PC client software for user's side.
Registered 40 technology based patents.

Completed the core technology developments related to user interface & web service.

Initiated the development of web version of Mol-Instincts database.

2014

Registered 1 business model based patent.

Awarded grand prize for the best patented products.
Launched the web version of Mol-Instincts database.

Completed the core technology developments related to embedded system and server infra & cloud system.

Initiated the development of ChemRTP.

Start R&D using drone related to embedded systems (for chemical plant management).

2015

Upgraded Mol-Instincts database by adding additional 1.7 million chemical compounds.

Launched ChemRTP online service.

Awarded 3rd government grant for an innovative technology development project granted by Ministry of Trade, Industry & Energy.

Attracted 2nd foreign direct investment.

Initiated the development of UnitPot.

Initiated the development of ChemTopia Platform.

Development of cloud system related to drone application (for chemical plant management).

2016

Launched UnitPot.

Launched the beta version of Chemtopia.

Initiated the development of 8 additional products or online services by applying ChemEssen's core technologies.

Upgraded the computing center by adding additional high-performance servers with 384 CPU cores.

Completed technology development of comprehensive solution related to drone application (for chemical plant management).

2017

Launched Roppor.

Awarded 4th government grant for a lightweight low-cost LiDAR development project granted by Ministry of Trade Industry and Energy.

Completed development of drone swarm flight technology.

Launched Naver Chemical Structure Dictionary with Naver.

Chemical and **IT** Area:

- Mol-Instincts
- ChemRTP
- ChemTopia
- UnitPot
- Natural Product Database

Drone Area:

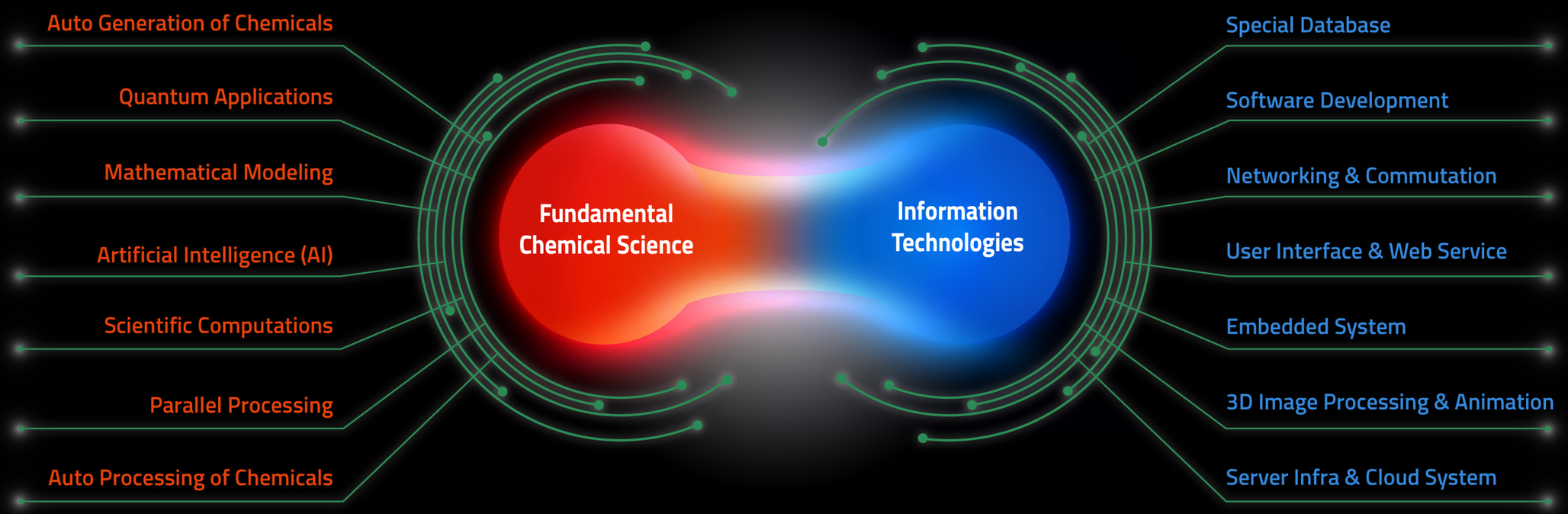
- Roppor

Business **Area**

Company **Structure**

CORE TECHNOLOGY MAP

OUR CORE TECHNOLOGIES ARE THE RESULTS OF FUSING
FUNDAMENTAL CHEMICAL SCIENCE AND INFORMATION TECHNOLOGIES.



From the chemical science side, our special algorithms can generate a massive number of chemicals quickly and automatically. Quantum chemistry is applied for fundamental analysis, and our advanced mathematical modeling and Artificial Intelligence (AI) technologies provide high-quality chemical information. Our special computation and processing technologies make it possible to run thousands of computers in parallel, which rapidly process billions of chemicals automatically.

Our special information technologies can provide a wide range of online services. Our database technologies are specialized for complicated scientific information, capable of searching the structures of billions of chemicals. Our software technologies can handle complex scientific phenomena, such as 3D chemical image processing and animation. We also have hardware-related technologies, such as networking, embedded systems, server infrastructure, and cloud system construction.

PRODUCTS

Five online services are currently in operation.

PRODUCT 01

Mol-Instincts | A New Chemical Database

World's Biggest and Most Comprehensive Chemical Database Based on Quantum Chemistry.

PRODUCT 02

Roppor | LTE Based Professional Drone Platform

Drone can be operated through LTE network and planed flight routes remotely from PC platform.

PRODUCT 03

ChemRTP | Real-Time Chemical Property Predictor

Provides Key Properties of Any Chemicals Fast in Real-Time on the Web.

PRODUCT 04

UnitPot | A New Scientific Unit Converter

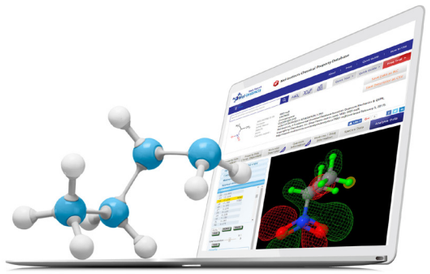
Converts Complex Derived Units with an Intuitive User Interface.

PRODUCT 05

ChemTopia | Networked Chemical Intelligence

Provides Top Quality Professional Data, Information, Software, and a Communication Forum.

PRODUCT
01

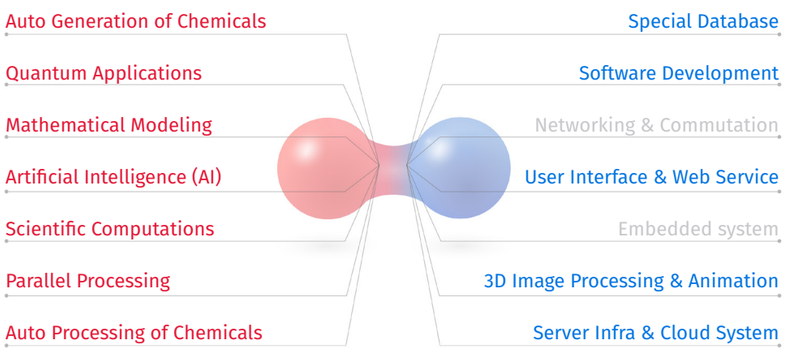


www.molinstincts.com

Mol-Instincts

World’s biggest and most comprehensive chemical database.

Core Technologies Used:



PREDICTED BASED ON QUANTUM CHEMISTRY.

Core Concepts

Mol-Instincts is a new revolutionary chemical database based on our proprietary quantum chemistry and scientific computation technologies. Unlike other data bases, all data and information are predicted with our in-house technologies and nothing is collected from third-parties. Our prediction accuracy was fully verified with existing experimental data available to date. Mol-Instincts is the world’s biggest and most comprehensive data base providing more than 10 billion sets of data and information, which is at least 100 times greater than any other data base in the market.

Key Features

A New Chemical Database

Mol-Instincts is world’s first chemical database based on Quantum Chemistry.

4+ Million Compounds and 8+ Billion Sets of Data and Information

Over 2,100 sets of data are available for each and every 4+ million compounds.

Accuracy Level of Above 95%

The level of prediction accuracy by Mol-Instincts has been verified to be above 95% in most cases when compared with experimental data available to date (other existing mothod, e.g., Joback Method provides 63% of the accuracy level for boiling point prediction).

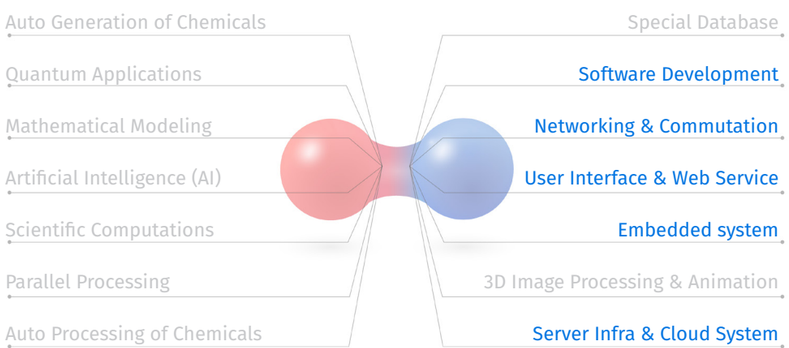
PRODUCT
02

www.roppor.com

Roppor

LTE based professional drone platform.

Core Technologies Used:



CENTRAL CONTROL SYSTEM OF MULTIPLE DRONES

Core Concepts

Roppor began as a drone project with remote autonomous flight and real-time monitoring due to the need to manage large scale chemical plants efficiently. It has evolved into a commercial drone platform that provides LTE based drone platform and cloud system for real-time video transmission and monitoring to enable sophisticated and advanced drone business. It is easy to mount on existing drone, remote flight control over 20Km is possible, and self-avoidance flight using LiDAR sensor is also possible. In addition, Roppor software allows you to control multiple drones simultaneously. And with a cloud system, you can run multiple drones on the central control system.

Key Features

LTE based Drone Platform Cosisting of Customizable Hardware, Software and Cloud System.

It is easy to install on existing drone frame, and autonomous flight and real-time monitoring can be done with Roppor software using LTE network.

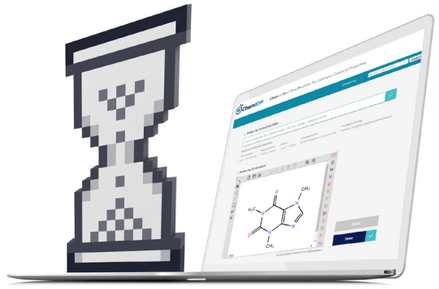
Swarm Flight and Autonomous Collision Avoidance

Multiple drones in-flight operating in different locations can be monitored and controlled simultaneously in real-time avoiding unexpected obstacles autonomously.

Cloud System enabling Central Control System

All the information acquired from the drone operation is stored automatically on a dedicated cloud server over the LTE network.

PRODUCT
03

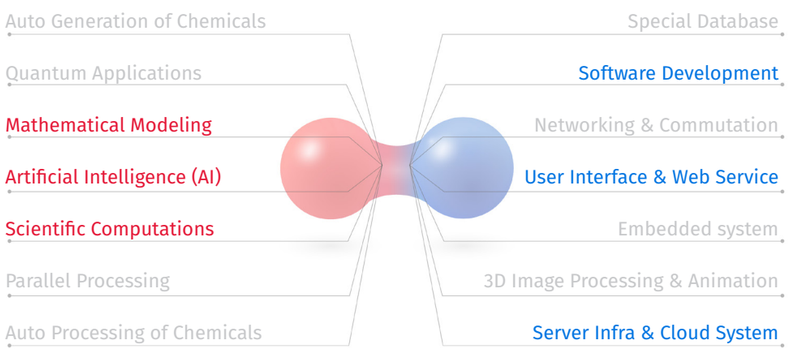


www.chemrtp.com

ChemRTP

Analyze any chemicals in real-time.

Core Technologies Used:



DATA ARE PROVIDED AS REQUESTED AT ANY TIME.

Core Concepts

ChemRTP quickly predicts chemical data and information for any chemical that the user defines. This is an improvement over other databases that can only provide stored data. It provides 28 important chemical data per chemical compound in real-time on the Web. Prediction accuracy is also provided if any experimental data are available to date in the chemical field.

Key Features

Predict Chemical Properties through QSPR Modeling

The most advanced QSPR model allows you to predict the properties of all chemical consisting of C, H, N, O, S, F, Cl, Br, I, and Si in real time.

Simple One-Click Prediction

After entering compounds using Chemical Name, Registry No., SMILES, InChI, Standard InChI, Standard InChIKey or 2D structure on the ChemRTP website, you can obtain various physical property information with just one click.

PRODUCT

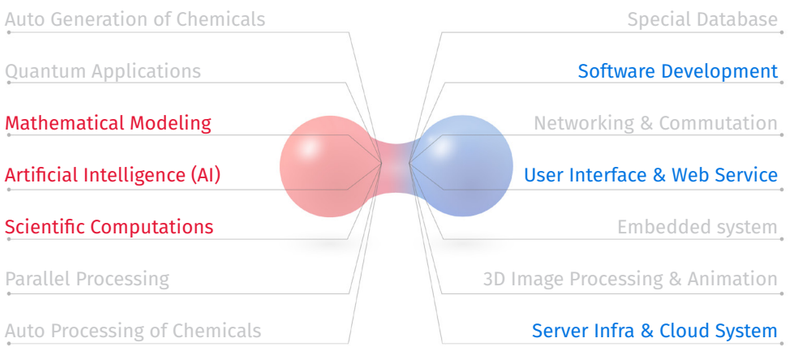
04

www.unitpot.com

UnitPot

Converting complex derived units with an intuitive user interface.

Core Technologies Used:



A TOTALLY NEW SCIENTIFIC UNIT CONVERTER.

Core Concepts

Unitpot is the soul unit converter that can be used in most fields on science like chemistry, physics, mathematics and engineering. By using Unitpot, you can convert any of derived units and find accurate values on it for more convenient way to enhance your research. Unitpot is the most advanced scientific unit converter which could convert any of derived units that combined with more than 2,860 units and 109 prefixes.

Key Features

Convert Complex Derived Units of All Combinations

Unitpot is the most advanced science unit converter that can convert derived units to support most of the world's units, including 2,860 units and 109 prepositions.

The Most Convenient Intuitive User Interface

UnitPot converts complex derived units with an intuitive user interface to maximize user freedom and ease of use of services. Unitpot provides dynamic conversion to match the eye level of the user.

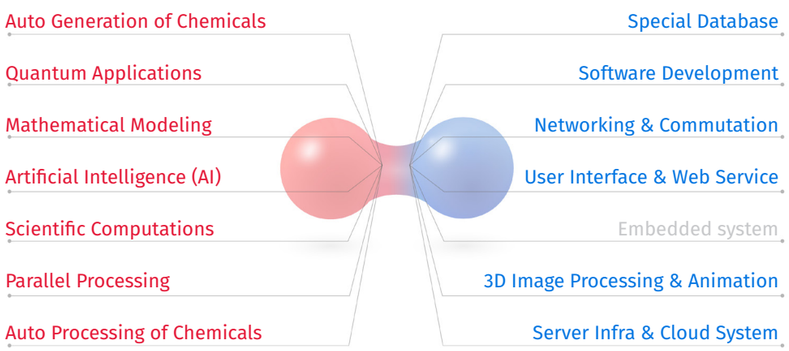
PRODUCT
05

www.chemtopia.com

ChemTopia

Networked chemical intelligence.

Core Technologies Used:



A SPACE FOR YOUR PROFESSIONAL R&D AND BUSINESS.

Core Concepts

ChemTopia is the world's first comprehensive intelligence networking platform targeting chemical industries. It provides top quality data, information, software, and a professional forum. You can find and contact the world's best experts in your area, discuss & solve difficult problems together, publicize your R&D activities and technologies globally, and perform professional business activities such as technology transfer and crowdfunding. It contains highly innovative native advertising and e-commerce algorithms.

Key Features

The world's only Intelligence Networking Platform

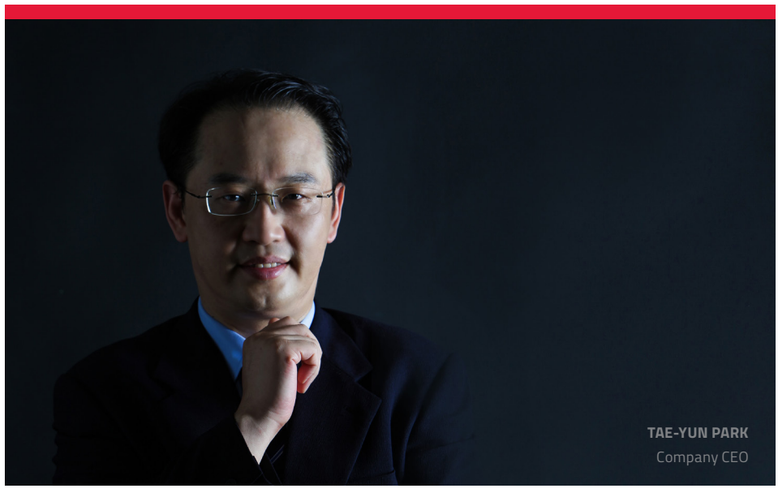
ChemTopia creates a communication network for chemists around the world to provide a forum between practitioners and professionals in the field.

Forums and Proleaders Consisting of Experts

In the forums, you can communicate with experts by chemical related posts. Registering as a Proleader will let other chemists know about your expertise.

Cheminfo / Modules / Chemcast

Chemtopia has a wide range of content in chemistry. Cheminfo, Modules, Chemcast can be used to collect chemical-related professional information.



Dr. Tae-Yun Park is the founder, CEO, and president of ChemEssen. He earned his B.S. from KAIST, and M.S. from POSTECH, South-Korea, both in Chemical Engineering. He received his Ph.D. from University of Ghent, Belgium under the direction of world-famous Professor Gilbert F. Froment.

After completing Ph. D. in 1998, Dr. Park moved to the US and worked for the major chemical companies for more than 6 years. Based on these experiences, he started up ChemEssen in 2006 in Seoul, South-Korea with the vision of next-generation database and software system.

Dr. Park is a specialist for chemical process development & optimization, and catalytic reactor design & analysis. He developed many chemical reactors and processes for industrial applications. From quantum chemistry to fluid dynamics, from atoms to commercial chemical plant, his work is firmly based on fundamental understanding of complicated phenomena in chemical applications.

Dr. Park is the author of over 15 international scientific publications and holds 41 patents in the area of chemical property estimations and commercial applications, and won a R&D fund of more than $11 million USD from the US Department of Energy in 2001.

CEO **Profile**

Education

- **Laboratorium Voor Petrochemische Techniek (LPT), Universiteit Gent** - Gent, Belgium
  - Ph.D. IN Chemical Engineering, 1998
- **Pohang Institute of Science and Technology (POSTECH)** - Pohang, South Korea
  - Master of Science in Chemical Engineering, 1992
- **Korea Advanced Institute of Science and Technology (KAIST)** - Daejeon, South Korea
  - Bachelor of Science in Chemical Engineering, 1990

Work Experiences

- **Lab. voor Petrochemische Techniek (LPT)** - Gent, Belgium l Research Fellow (1992 ~ 1998)
- **Catalytica Energy Systems, Inc** - California, Mountain View l R&D Engineer (1999 ~ 2001)
- **SABIC Americas, Inc** - Texas, Houston l Process Engineer (2001 ~ 2005)

Key Achievements

- Win Research Awards of $11,169,000 from Department of Energy in United States.
- “Plate- Reactor Based Fuel Processing System”, United States Provisional Patent Application.
- Published 15 papers in world's leading scientific journals.

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"Far and away the best prize that life offers is the chance to work hard at work worth doing."

Theodore Roosevelt

ChemEssen