Progress of Chemistry in South Korea

by Choon H. Do

The Lamp of the East

In the golden age of Asia
Korea was one of its lamp-bearers
And that lamp is waiting to be lighted once again
For the illumination in the East.

—Rabindranath Tagore (1861-1941)

It was an historic event for the Korean Chemical Society (KCS) to host the 45th IUPAC World Chemistry Congress (WCC) and the 48th IUPAC General Assembly (GA) in August 2015. It was the first time that the WCC and GA have been hosted in Korea since KCS became a member in the early 1960s. KCS applied for membership in 1961 and the application was approved the following year. Dr. Dong Il Kim and Prof. Sun Kyung Kim attended the 22nd GA in London in 1963 as the first KCS delegates.

Several international conferences sponsored by IUPAC have been held in Korea: Chemrawn IX on the Role of Advanced Materials in Sustainable Development was held in Seoul in September 1996, the 36th International Symposium on Macromolecules (MACRO) was held in Seoul in August 1996, and the 19th International Conference on Chemical Education (ICCE) was held in Seoul in August 2006.

To mark this year's special occasion, when the IUPAC WCC and GA are held in Busan, Korea, *CI* invited Choon H. Do to describe the history and the future prospects of chemistry in Korea.

Ancient Chemistry in Korea

According to a legend on the establishment of Korea, the Korean people are descendants of Dangun, the son of a Heavenly God who came down to Korea with "rain, cloud, and wind" and married a woman transformed from a bear by taking garlic and mugwort for three weeks. In BC 2333 they set up a kingdom named Gojoseon (Old Joseon). Interestingly, this legend tells us that Koreans recognized from a long time ago the importance of the environment and chemistry to sustaining human life. Rain, cloud, and wind are important factors for agriculture, and garlic and mugwort were used as medicines in ancient Korea. It also depicts the Korean endurance for hardship.

According to unearthed remains, Koreans have inhabited the Korean peninsula from the Paleolithic period. A petroglyph at Daegok-ri, Ulsan, probably carved in the Bronze or Iron Age, shows several types of whales, animals, and tools for hunting (Fig. 1). Among other things, these early inhabitants knew how to hunt giant whales and record these events on the stone wall in an artistic manner.

After Gojoseon, some of the northern territory of Korea was occupied by China's Han Dynasty and was renamed Hansagun. In the meantime, three kingdoms—Silla, Goguryeo, and Baekje—were established in BC 54, BC 37, and BC 18, respectively. From the period of these three kingdoms, the history of Korea is relatively well documented. The three kingdoms were unified by Silla in AD 668 and the Silla Dynasty lasted until AD 935. Gun Wang set up the Goryo Dynasty in AD 918 and overthrew Silla in AD 935 to rule Korea. The Koryo Dynasty lasted until 1393, when General Sung-gye Lee, the leader of a military coup in 1392, set up the Joseon Dynasty and became a King himself. The Joseon Dynasty was merged into Japan and dissolved in 1910. Japan occupied and ruled Korea from 1910 until 1945. Korea became independent from Japanese rule on 15 August 1945 at the end of World War II. The Korean peninsula was divided in two, with the northern part ruled by the Soviet Union and the southern part by the United States from 1945 to 1948. South Korea

Fig. 1: Petroglyph in Daegok-ri, Ulsan, Korea. Lines were redrawn for emphasis.

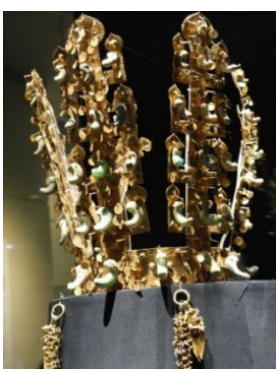


Fig. 2: Gold crown in Silla Dynasty

Fig. 3: Glassware imported from Persian region

Period	Names of Nations
Ancient Korea	Gojoseon (BC 2333-BC 108) Hansagun (BC 108 –AD 314)
Three Kingdoms Period and Unified Silla Kingdom	Silla Dynasty (BC 57-AD 935) Goguryeo Dynasty (BC 34-AD 668) Baekje Dynasty (BC 18–AD 660)
Medieval and early modern Korea	Goryo Dynasty (AD 918-1392) Joseon Dynasty (AD 1392-1910)
Occupation period by Japan (1910-1945)	
Independence (1945)	
Modern Korea, Korean War (1950-1953)	South Korea (1948–present) North Korea (1948–present)

Table 1: A Brief History of Korea

was formally established 15 August 1948 with observation by UN Temporary Commission on Korea, and North Korea was established 9 September 1948. The Korean War erupted 25 June 1950 and lasted until a cease-fire was declared 27 July 1953. This cease-fire remains in place today. The history of Korea is briefly outlined in Table 1.

Chemistry in the Three Kingdoms Period

We can guess the state of chemistry in the Three Kingdoms Period through the archaeological remains of the Silla Dynasty. These survived at a relatively higher rate than those of the Goguryeo and Baekje Kingdoms. Of these remains, gold crowns, steel lumps, and glassware are notable for chemists. Figure 2 shows a gold crown excavated from a tomb of the Silla Dynasty period. Many other remains were also made of gold. Silla produced significant gold and knew how to handle it. Iron lumps in shallow sheet shapes were also found in tombs. These iron lumps were first produced as a sponge iron form and then hammered into wrought iron. These iron lumps were used as basic materials for tools such as armor, helmets, and agricultural implements, and were exported to Japan and China according to written documents.

Fig. 4: A stone soldier statue in front of the 38th ruler, King Wonseong's tomb (reign period: AD 785-798)

From the Three Kingdoms Period Korea was an open society and traded with foreign countries freely. Glassware shown in Figure 3, for example, might come from the Persian region. Another very interesting example is a stone soldier standing in front of the tomb of King Wonseong (reign period AD 785-798), 38th King of the Silla Kingdom (Fig. 4). The figure of the stone soldier is similar to western figures, and indicates that foreigners lived in Korea from ancient times. According to legend, Queen Hwangok Huh came from India in AD 48 and married Suro Kim, the founding King of the Garak Kingdom, a small kingdom between Silla and Baekje that was later merged into Silla. She became the progenitor of the Korean surname 'Huh'.

Chemistry in Medieval and Early Modern Korea

During the period between the 10th and early 20th centuries AD, two dynasties, the Koryo (918-1392) and Chosun (1392-1910), rose and fell in Korea. Because the society of these two dynasties was disrupted for long times by invasions from Mongolian and Chinese forces from the north, and by Japanese forces from the south, Koreans had difficulties developing new sciences and technologies. Nevertheless, a few noticeable developments were made.

Invention of metallic type and printing

A Buddhist book, 'Jikji', printed in 1377 in Goryeo Dynasty using metallic type, is stored in the Manuscrits Orientaux division of the National Library of France (Fig. 5). This book was confirmed as the world's oldest extant book printed with movable metal type by UNESCO in September 2001 and is included in their Memory of the World Programme. It shows that Koreans continuously improved science and technology not only for sustenance, but also for spiritual progress.

Compilation of medical knowledge

Medical and medicinal information is always very important to human life. In 1613, the Korean court physician Jun Huh and his colleagues compiled a book, 'Dongeuibogam' (Principles and Practice of Eastern Medicine), an encyclopedia of medical knowledge and treatment techniques. Many prescriptions are still applied today and are sources of research in herbal medicine. The book also describes the ideals of preventive

Fig. 5: 'Jikji' (left), the oldest extant book printed with movable metalloid type; and the medical books Dongeuibogam (right), part of the UNESCO "Memory of the World" Programme.

medicine and public health care by the state, ideals that are very advanced even from the modern point of view. Dongeuibogam was added to the Memory of the UNESCO World Programme in 2009 (Fig 5).

Invention of Korean alphabet, 'Hangeul'

The invention of Korean alphabet, "Hangeul", in 1446 by a group of scholars designated by King Sejong (Fig. 6), is worth mentioning. It was easy for Koreans to learn, and consequently became an excellent tool for learning and communication. The Korean alphabet is composed of 14 consonants and 10 vowels. The shapes of the consonants and vowels are shown in Table 2. One will notice that the shapes are simple, geometrical, and symmetrical. Ordinary people can learn this system in a short time, and it can describe foreign languages without difficulty. It is also a very good fit for modern computer tasks. Needless to say, the invention of the Korean alphabet contributed greatly to the development of science and technology in Korea.

'Hermit nation' and 'Morning calm'

Evidence shows that Koreans did not actively make contact with foreign countries between the 10th and 20th centuries, except for China and Japan. Korea remained unknown in western countries for a long time. Then, in 1668, a Dutch sailor named Hendrick Hamel wrote a report, "Hamel's Journal and a description of the Kingdom of Korea (1653-1666)", after escaping from Korea. In 1653 Hamel and other sailors had landed in Korea after their Dutch merchant ship was wrecked. They were held for 13 years. Hamel's journal was edited into a book and Korea became known to westerners. At this time, Korea became known as the 'Hermit nation' and the 'Morning calm' country.

It's is not known precisely why Koreans didn't continue contact with westerners during these long periods. However, the leaders and scholars of those periods failed to match the progress of the modern civilizations of the world. One theory, although it is not proven, is that recovery from the invasion and oppression by outsiders took a long time. Some leaders tried to establish contact with western civilization in the 19th century, but their impacts were weak. At the start of the 20th century, Korea lost its opportunity to catch up by itself and came under Japanese occupation when the Joseon Dynasty was merged with Japan in 1910.

Table 2: Korean alphabet, "Hangeul"

Consonants (14 characters)	ㄱ ㄴ ㄷ ㄹ ㅁ ㅂ ㅅ ㅇ ㅈ ㅊ ㅋ ㅌ ㅍ ㅎ
Vowels (10 characters)	ㅏ ㅑ ㅓ ㅕ ㅗ ㅛ ㅜ ㅠ ㅡ ㅣ

Fig. 6: The Great King Sejong, who invented 'Hangeul', the Korean alphabet, is shown on the 10,000 Won Korean banknote.

Independence and Post-Korean War Reconstruction

As a result of the conclusion of World War II, Korea gained its independence 15 August 1945. Living under the oppression of other countries had been difficult, and the oppressed society lacked human rights, as well as the structures required to develop proper

education, science, and creative minds. Korea had one misfortune on the top of another. Koreans experienced the tragedy of fratricidal war between 1950 and 1953. Some of the remaining resources left after independence were reduced to ashes by the war.

Immediately following independence, only a few Koreans obtained a Ph.D. degree and the number of graduates majoring in engineering and sciences at Korea's universities and technical high schools were mere hundreds. To change this, the Korean Chemical Society (KCS) was established 7 July 1946. The specialties of the 36 charter members included chemistry, chemical engineering, agriculture, and medicine.

During and after the war, many foreign countries helped to reconstruct Korea. They supplied not only food and clothes but also construction materials for housing and schools for education. They helped to set up factories and to build roads. Some of this foreign aid came from the United Nations Korean Reconstruction Agency (UNKRA), created by the United Nations to help economic reconstruction in 1950 and focused on aiding war refugees and the homeless. The United Nations Development Programme (UNDP) aided Korea from 1963, while the Development Assistance Committee (DAC) of the Organisation for Economic Co-operation and Development (OECD) also helped to rebuild Korea's economy. The U.S. Agency for International Development (USAID) also assisted South Korea in building its agricultural, educational, and industrial sectors. According to DAC data, the total foreign assistance to Korea was USD 13 billion. This foreign assistance was used to overcome poverty and achieve economic development—in 2000 the UNDP reclassified South Korea from recipient of aid to a donor. During this period, many elements of western culture and institutions were introduced into Korea. Commodities such as coffee, penicillin, canned food, and nylon socks were imported. 'Jeep', 'three-quarter' and 'GMC' became common names for small passenger cars and medium and large trucks at the time.

Policy makers recognized what should be done to reconstruct the country, to eliminate hunger and poverty, and to provide shelters for people suffering from war, and executed their plans. With the assistance of various international organizations and foreign countries, the Korean government and the country's private sectors began to help themselves. Mungyung Cement Co., Gyungbuk, was established in October 1957 with Dutch technologies. Sheet Glass Manufacturing Plant in Inchon was built in 1957 through the aid of UNKRA. An automatic glass bottle factory was set up with help from the United States. A fertilizer plant was built in Chungju, Chungbuk in 1959. It produced urea fertilizer and was the first chemical plant in South Korea. The plant not only produced fertilizer, but also had a role in educating many chemical engineers and scientists who later became leaders in the chemical industries. Inchon Iron factory started to produce steel from open-hearth furnaces in 1956. Polyurethane slabstock foam was produced in 1957 by importing technology and raw materials from Bayer, of Germany. South Korea began to have some basic industries and plans for further development by late 1950.

Current Status of Chemical Industries

Today, the production of Korean chemical industries is about EUR 132.1 billion and ranked 5th in the world (Fig. 7). In 2013, the total exports of these industries were USD 83,535 million, while the imports were USD

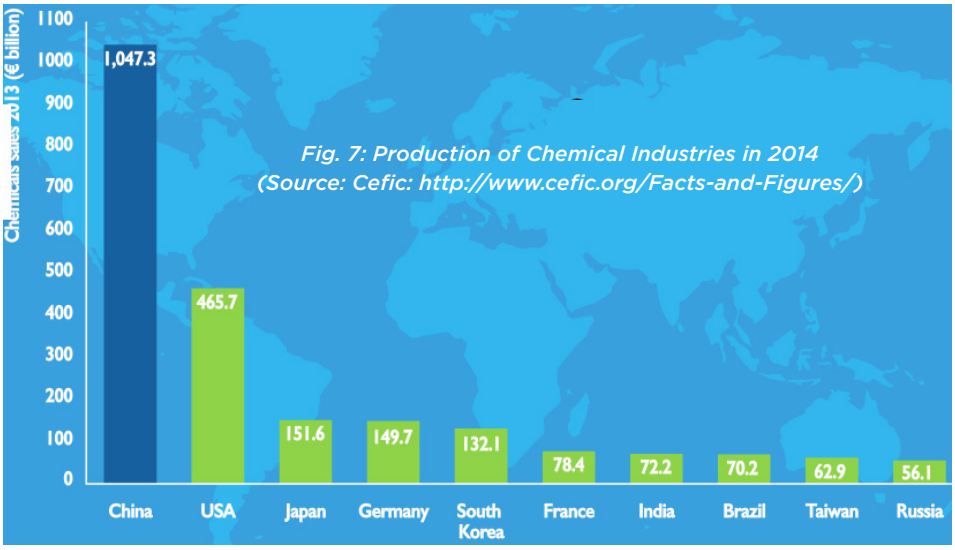


Fig. 7: Production of Chemical Industries in 2014 (Source: Cefic: http://www.cefic.org/Facts-and-Figures/)

Fig. 8: Commemorative stamp for the set-up of an oil refinery as one of 5-year economic development plan (1964).

Fig. 9: Ulsan Petrochemicals complex

60,014 million. (2014 Annals of Science and Technology, Ministry of Science, ICT & Future Planning, S. Korea). This includes petrochemicals, fine chemicals, fertilizers, ceramics, paper and its raw materials, abrasion products, plastics, and rubber products. The total balance of Korea's chemical industries trade is in the black, but shows deficits of USD 9,180 million in the trade of fine chemicals, USD 2,184 million in industrial chemicals, and USD 2,998 million in ceramics. These data indicate that chemical industries in Korea are still behind in fine chemicals and specialty chemicals and need to invest and develop these fields.

Petrochemicals

As initial reconstructions commenced after the Korean War, a military coup arose in 1961. The new government executed a series of economic development plans. Ulsan Petrochemical Complex was established between 1968 and 1973. An Oil refinery producing 35,000 bbl/day was built in 1964 in a joint venture with Gulf Oil (Figs. 8 & 9)—many companies were established either through a joint venture or independently. The first naphtha cracking facility, needed for the production of polymers and petrochemicals, was set up in 1973, and

Fig. 10: Location of Ulsan, Yosu, and Daesan petrochemicals complexes.

Nylon 6 was produced by Hankook Nylon Co. in 1963. The production of PE, PP, PS, PVC, PET, BR, SBR and acrylic fiber started. Ulsan became the largest city for petrochemical production in Korea. Currently they are focusing on the bio-, nano-, and fine-chemicals fields.

After Ulsan Petrochemicals Complex, Petrochemical complexes were set up at Yosu in 1976-79 and at Daesan in the 1990s (Fig. 10). Global chemical companies such as BASF, BP, Solvay, S-Oil, Mitsui, Eastman Chemical, Rhodia, DuPont, Mobil, Total, and Dow are now operating in Korea.

Fig. 11: Stamp commemorating the construction of POSCO (1973)

Iron and Nonferrous metals

Pohang Iron & Steel Company (POSCO) was set up by a joint venture between Korean and Japanese companies in 1968 and begun production of steel in 1972 (Fig. 11). POSCO built a 2nd mill in Gwangyang in 1988. Onsan Industrial Complex in Ulsan was planned in 1974 for the production of nonferrous metals, aluminum, copper, zinc, nickel, and lead, and completed in 2000. Through the production of plastics, steel and nonferrous metals, they were able to supply basic materials for the automobile, shipbuilding, and electronics industries.

Government and National Research Institutes

The Korean government eagerly supports the progress of economic development and science and engineering. The Ministry of Education; the Ministry of Science, ICT & Future Planning; and the Ministry of Trade, Industry & Energy are the main engines to propel the policy of the Korean government supporting education, research, innovation, science, and technology. They have set up many national research institutes

and organizations. Some important institutes are described below:

Central Industry Research Institute: This institute, established under the Ministry of Commerce & Industry in 1949, was the first governmental agency for science and technology. As the only place where most scientists and engineers could work after independence, they shaped the first community of science, technology, and industry.

Korea Atomic Energy Research Institute (KAERI): At the time that nuclear power was emerging, and as people witnessed the nuclear power of the bombs dropped on Japan, the newly born Korean government focused on catching up with contemporary nuclear science and technology. The Korean government initiated KAERI and imported a research reactor, the Triga Mark II from General Atomics in 1962 for peaceful use—agriculture, industry, medicine, science, and engineering. Using this research reactor, they trained not only nuclear scientists and engineers but also pure scientists and engineers. They have also recruited scientists and engineers from abroad. Currently, South Korea is operating 23 nuclear power reactors, producing 20.7 billion watts and supplying 35% of the country's total electricity.

Korea Institute of Science and Technology (KIST): During summit talks in 1965, Korean President Chunghee Park and U.S. President Lyndon B. Johnson agreed to establish a research and development institute in Korea. A deal to establish KIST was signed in 1966 and the Institute was completed in 1969. It was the first multi-disciplinary scientific research institute in Korea and has since contributed significantly to the development of the Korean sciences in many areas. As scientists and engineers joined KIST, the research positions there created the first major "reverse brain-drain" from overseas.

Korea Research Institute of Chemical Technology (KRICT): KRICT was established in 1978 with the aim of applying chemistry research to strengthen the Korean chemical industry's international competitiveness.

There are many other institutes established by the Korean government or with governmental support. Some of these related to chemistry are the Institute for Basic Science (IBS), Korea Research Institute of Bioscience and Biotechnology (KRIBB), Korea Basic Science Institute (KBSI), Electronics and Telecommunications Research Institute (ETRI), Korea Testing & Research Institute (KTR), Small & Medium Business Administration (SMBA), Korea Textile Development Institute (KTDI), and Korea Institute of Footwear & Leather Technology (KIFLT).

Chemical Education and Universities

Before independence, there was one university, and few private technical colleges and technical or agricultural high schools. Following independence, the Korean people quickly re-established the national education system using a small reservoir of human resources in education. National Universities were established in each province. Many private universities were also established with influential support.

Seoul National University was established in 1946 by combining Kyungsung Imperial University and other technical colleges that existed before independence. Other national universities were established at Busan, Kyungbook, Chonnam, Chonbuk, Chungbuk, Chungnam, Gangwon, and Jeju.

The private universities have diverse foundation origins. Yonsei University, with roots from 1885, became a college in 1915 and university in 1957. Its beginnings come from a hospital founded by American protestant missionaries of the Presbyterian Church. Korea University was established in 1946 by renaming Bosung Technical College, which was established in 1905 by a private supporter. Sungkyunkwan University traces its roots to the Korean Confucian educational system and rituals of the Chosun Dynasty. It was founded in 1398, although its current university system was enacted in 1946. Inha University was established in 1954 through donations by Korean emigrants living in Hawaii in the hope of assisting development in Korea through education. Ewha Womans University is the first women's university in Korea. It was founded in 1886 by the American Methodist Episcopal mission, and the current university form was established in 1945. Sookmyung Women's University was established in 1906 as the first royal private educational institution for women.

The number of universities and colleges increased very quickly following independence and through the modern era due to "education fever". Currently there are 190 4-year universities and 140 2-year colleges in Korea. More than 80% of high school graduates register at college or university.

After the Korean War, the education system followed that of the United States. One notable program during this time was the Minnesota Project by USAID.

	Journals	Magazines
KCS	*Bull. Kor. Chem. Soc.* (in English), *J. Kor. Chem. Soc.* (in Korean)	*ChemWorld*
KIChE	*Kor. J. Chem. Eng.* (in English), *Kor. J. Chem. Res.* (in Korean).	*News & Info. For Chem. Eng.*
PSK	*Macromol. Res.* (in English), *Polymer* (in Korean)	*Polym. Sci. & Tech.*
KSICE	*J. Ind. Eng. Chem.* (in English), *Ind. Chem.* (in Korean)	*Prospectives of Ind. Chem.*
CerS	*J. Kor. Ceram. Soc.* (in Eng. & Korean)	*Ceramist*
KSBMB	*Exp. Mol. Medicine* (in English), *BMB Reports* (on-line J.)	*KSBMB News* (on-line only)

Table 3. Some key Societies and their publications

This program provided universities in Korea with staff improvement and equipment in engineering, medicine, agriculture, and public administration. Through this program, faculty members visited the United States to obtain a degree and to catch up with the development of modern science and technology. Many scholars also went to Germany, France, and other European countries.

At most universities, the chemistry departments were placed in the college of liberal sciences, while chemical engineering departments were set up in the college of engineering. Departments of applied chemistry, industrial chemistry, fiber technology and polymer were also established in the college of engineering. The chemists and chemical engineers trained in all of these departments became the workhorses of the chemical industry in Korea.

Relatively recently, several notable national and private universities were established. Postech (former Pohang Institute of Technology) was established in 1986 by the support of POSCO, while Korea Advanced Institute of Science and Technology (KAIST) was established in 1971. Following the model of KAIST, regional universities with the same purposes have been established: Gwangju Institute of Science and Technology (GIST) in 1993, Ulsan National Institute of Science and Technology (UNIST) in 2009, and Daegu Gyeongbuk Institute of Science and Technology (DGIST) in 2011.

Chemical Scientific Societies and Associations

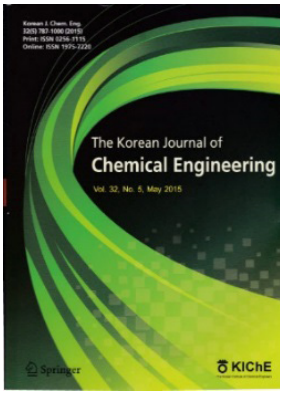
Many chemists and chemical engineers are active in research and in presenting their works through various domestic and international scientific societies. Chemists and chemical engineers organized many societies according to their scientific interests and disciplines. Each society actively holds meetings, conferences, and forums and publishes journals, magazines, and newsletters. Because most scientific terms and definitions came from abroad, many scientific societies translated English terms they used into Korean terms. To this end, the Korean Union of Chemical Science and Technology Societies (KUCST) published "Terminologies of Chemical Science & Engineering" including chemistry, chemical engineering, and polymer and industrial chemistry.

Scientific societies related to chemistry and chemical engineering are as follows (year of establishment in parentheses): Korean Chemical Society (KCS) (1946), Korean Institute of Chemical Engineers (KIChE) (1962), Polymer Society of Korea (PSK) (1976), Korean Society of Industrial and Chemical Engineering (KSIEC) (1990), Korean Ceramic Society (CerS) (1957), Korean Society of Biochemistry and Molecular Biology (KSBMB) (1948), Korean Society for Biomaterials (KSB) (1996), The Rubber Society of Korea (RSK) (1966), and Korean Electrochemical Society (1983)

Small specialty societies are also emerging: Korea Polyurethane Society (2004), Korean Hydrogen and New Energy Society (2005), Korean Silicon Society (2011). Further, chapters of many international chemical societies are active in South Korea, including the American Chemical Society, The Royal Society of Chemistry, and the Society of Plastics Engineers.

Many different sections of chemical industries, such as textiles, rubber, plastics, electronics, steel, automobile, fertilizer, construction materials, cosmetics, and medicine, etc., form professional associations to

share information on new technologies, environmental effects, and safety. They have contributed to the development of Korean chemical industries greatly. Some examples are Korea Chemical Industry Council (KOCIC) and Korea Petrochemical Industry Association (KPIS). KOCIC's purpose is to promote the exchange of information and cooperation with various organizations from the global chemical industry, such as the International Council of Chemical Associations (ICCA). KPIS was created for the development of the petrochemical industry and to facilitate international cooperation.



Future and Challenges

2015 is the 70th year after Independence and comes over 60 years after the Korean War. Currently active chemists and chemical engineers are therefore the 3rd and 4th generations after independence and modern chemistry were introduced to Korea. They are a very talented group and expect to lead the current and next generations in contributing to the state of the art of global chemical science. Many of them are world class chemists and chemical engineers. (see Chemists and Chemical Engineers in S. Korea, published online at www.chemistryculture.org/en-chemculture/en-koreanchemistandengineer.htm)

Some problems may arise in the future, such as the reduction in population and downsizing of the economy. As in other developed countries, Koreans are also facing challenges relating to the environment, sustainability, and the need to increase the public understanding of chemistry. We have to plan for the future. It is less than 20 years since Korean society began to heavily invest in research science and technology. We spent a long time laying the foundation. Now we expect the ability of chemical talents. With open-minded sprit of inquiry and curiosity toward chemistry and education, Korean chemical scientists will research and cooperation with scientists of overseas.

Scientists couldn't show their talents under the oppression and the restriction of opportunities that existed under the feudal social system and in the colonial period. Progress is hardly made under war and disorder, or in an uneasy society where human beings suffer from poverty and hunger. The development of the Korean chemical industries is an example of the progress that can be made in a peaceful and free society.

Epilogue—Busan harbor, gateway for connection with overseas

Busan is the 2nd largest city in S. Korea and its population is about 3.5 million. The city was a temporary capital for the Republic of Korea during the Korean War. Busan port was the place where relief goods and war supplies were unloaded during the war, but now it is the largest container port in Korea, and the 5th largest in the world.

Busan exhibits the prosperity of the Korean people after overcoming the difficulties, hunger, and poverty caused by the war and the colonial period. Busan has many stories. A documentary film by R. J. McHatton, "Ship of Miracles" tells the story of the rescue of over 14 thousand refugees by a single ship, the SS Meredith Victory. It is the largest rescue operation in the history of mankind. The refugees landed safely in the southern part of Busan, where they became Busan citizens. A UN Memorial Cemetery commemorates the soldiers of 16 nations who participated in the war on the side of South Korea.

I trust the meeting of IUPAC General Assembly and World Chemical Congress in Busan has been an opportunity not only for chemists and chemical engineers to discuss chemical issues and present their research, but also for IUPAC to show to the world that chemists and chemical engineers change and improve human life for the better. This occasion was also a fresh opportunity to upgrade the level of chemistry in Korea.

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