THE KENTECH POST

Energy of the future

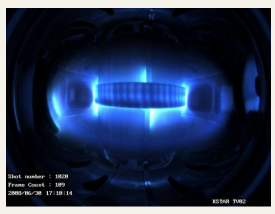
THE KENTECH ESP CLUB NEWSPAPER, EST. 2022 | VOLUME I NO. 1 | NAJU, JEOLLANAM-DO | MONDAY, DECEMBER 5th, 2022

CURRENT EVENTS: Page 2

Spotlight on The Industry-University Cooperation Center

CURRENT EVENTS: Page 5

Nuclear Fusion Review



TRAVEL REVIEW: Page 6

Mokpo, Jeollanam-Do

FRAUNHOFER COLLABORATES WITH KENTECH

By **GAHYEON LEE**

A world-renowned German energy research institute, Fraunhofer, has established the world's first hydrogen energy FIP Institute in collaboration with KENTECH. On September 14, the opening ceremony of FIP-H2ENERGY@KENTECH Research Institute was held at the KENTECH Hall.

Fraunhofer is a German government-funded research institute, and is one of the biggest in Europe with 76 laboratories and 30,000 employees across the country. FIP is a research unit created in collaboration with Fraunhofer institutes from Germany, hosted and operated by a university or a non-commercial research organization worldwide.

For further information, I conducted an interview with Professor Jihyun Hwang, the managing director of the FIP project and professor of hydrogen energy at KENTECH.

Korea Energy Technology University President Yoon Eui-joon (third from left), Research Vice President Park Jin-ho (fifth from left), and Hydrogen Energy Track Professor Hwang Ji-hyun (sixth from left) attended theFIP-H2ENERGY@KENTECH agreement ceremony at the Korea-German Hydrogen Conference. along with representatives from Fraunhofer

Professor Jihyeon Hwang standing in front of the newly opened HYLOT laboratory at KENTECH.

Q: IT IS A WONDERFUL THING - THIS FRAUNHOFER COLLABORATION. HOW AND WHY DID THIS START?

A: “Fraunhofer has been searching for several years to establish a Hydrogen Energy FIP Laboratory. At that time, I was scheduled to be hired by KENTECH, and I was introduced to the hydrogen executive at Fraunhofer headquarters by Park Jin-ho, vice president of research at KENTECH. After that, I had a lot of discussions, but I wasn’t thinking of creating a research institute then.

While sharing ideas, we found that Korea and Germany have many geographical and natural limitations to produce green hydrogen solely. Also, Korea has strengths in utilization, and Germany in production, storage, and transportation. Therefore, we came to the idea of working together to create a synergy effect. After a long discussion, the establishment was promoted in June last year by exchanging letters of intent for mutual cooperation related to the establishment of FIP. After that, my lab, HYdrogen Liquefaction & value chain Optimization Technologies (HYLOT), selected six research institutes from Fraunhofer that will establish the Hydrogen Energy FIP Laboratory – ‘FIP-H2ENERGY@KENTECH’, which will focus on storage, transportation, production, materials, and hydrogen safety & logistics.”

Q: Are there any hardships you had to overcome throughout the project?

A: “We had a very limited period of time in creating the world’s first hydrogen energy research institute. We had to physically overcome jet lag in many meetings with Fraunhofer in Germany; due to time difference, and also dealt with issues related to establishment. I often had to continue meetings and schedules until dawn, and that was one of the hardships I had to overcome."

"In addition, I had as many as seven interviews with the heads of six institutions and headquarters selected by Fraunhofer before receiving the final approval for the establishment of this research institute. On top of that, KENTECH was selected as the finalist, scoring higher than other candidates in the evaluation of faculty and research capabilities in the hydrogen energy field, and students' potential. In the process, there were many overseas business trips, which was also exhausting. However, it was a valuable experience, and I am very happy as it is the foundation for our KENTECH to become a global school.”

Q: In what fields is FIP-H2ENERGY@KENTECH’ planning to participate in?

A: “We concluded that hydrogen storage and transportation are challenging technologies, with high marketability and technology value from the perspective of hydrogen energy value chains. So, our FIP lab has drawn a roadmap for four major research areas, focusing on hydrogen storage and transportation, rather than those of fuel cells that are already in the ‘red ocean.’ These are our four research areas:

1. **Renewable energy-linked production**
2. **Hydrogen storage and transportation**
3. **Materials**
4. **Hydrogen safety and logistic**

Gahyeon Lee is a freshman at KENTECH majoring in Energy Engineering, and an undergraduate research student in the HYLOT (Hydrogen Liquefaction & Value Chain Optimization Technologies) lab. She is a member of the ESP Newspaper Club and an active contributor to this current events section.

KENTECH POST KENTECH POST

KENTECH 한국에너지공과대학교 Korea Institute of Energy Technology

Professor Jihyeon Hwang working closely with his team at HYLOT

"We plan to develop and commercialize source technologies related to storage and transportation. KENTECH and Fraunhofer are planning to:

1. Jointly build a lab-scale facility for research on green hydrogen production, storage, and transportation technology.

2. Build a pilot-scale plant for commercialization verification.

3. Transfer technology through close cooperation with local industries in Germany and Korea.

"In addition, KENTECH will focus on the Hydrogen Energy FIP Research Institute and develop powerful R&D in fields of technology, economy, and society through license development for hydrogen core technology."

Q: Undergraduates are also excited about this, but they have little idea about its benefits. How will it affect KENTECH students?

A: "Through the FIP-H2ENERGY@KENTECH, we are able to actively promote joint research and education with Fraunhofer for undergraduate students at Kentech. Employment and joint degree courses in Europe are available, and we are the only University in Korea to offer this. Undergraduates and graduate students in KENTECH will be able to have these opportunities for international joint research and education, which will have a significant impact on their future careers."

Q: What is your final goal that you wish to achieve?

A: "My goal is to make KENTECH the world's leading university in hydrogen energy education and research. We expect that the newly opened Fraunhofer-Kentech Research Institute will contribute greatly to achieving our goal of becoming one of the world's top 10 universities in energy. KENTECH wishes to play a pivotal role in hydrogen energy-related education and research for the world, and for this, close exchanges with research institutes, companies, and schools with global research capabilities are very important. In this respect, the establishment of the Fraunhofer Institute, which has the best research capability in Europe on hydrogen energy, collaborating with KENTECH has great value."

"Accomplishing this initiative won't be easy because it's a fresh start on the ground, but I thought I could accomplish anything with my passion and strong will."

Director Kwang-Hyon Kim's remark on the Industry-University Cooperation Center's future

A flow chart representing the initiatives of FIP-H2ENERGY@KENTECH

MEET THE DIRECTOR OF THE INDUSTRY-UNIVERSITY COOPERATION CENTER

By **MINGYU JEON**
Assistant Editor

Vision of KENTECH and Energy Valley Industry

Throughout the world there are few special places that have the ability to alter the world through startups; like Silicon Valley - which is referred to as the dream location of engineers. At KENTECH we are working to solve important problems regarding energy engineering, the environment, and climate change. Companies, rather than research, have a direct impact on solving the world's problems. Therefore, we plan to make a KENTECH Cluster that creates Industry-University-Research Cooperation.

I interviewed Director Kwang-Hyon Kim, the head of KENTECH's Industry-University Cooperation Center, and we spoke about his mission and vision pertaining to KENTECH's startup system.

Q: I was very curious as to what Director Kim did before coming to KENTECH and how he began his initiative. Specifically how his experience as head of the D.CAMP (Banks Foundation for Young Entrepreneurs) and the head of the KISED(Korea Institute of Startup and Entrepreneurship Development) has shaped his current view as Director of KENTECH's Industry-University Cooperation Center.

Director Kim: "I read a lot of energy-related books while taking a break at home after serving as the head of the Korea Institute of Startup and Entrepreneurship Development. 2050 Energy Revolution, 2050 Hydrogen Energy, Korea Carbon Neutral 2050, etc. After reading about 10 books, I realized, 'energy conversion' is very important. I thought it would be as important as the spread of the Internet 20 years ago or the spread of smartphones 10 years ago. While I was thinking that it would be important to nurture high-quality energy talents, an announcement was made that the KENTECH (Korea Institute of Energy Technology) was hiring a person in charge of business start-up support. So I applied right away without asking anything."

"When I applied, my thoughts were clear. It was: 'Let's create the best university to start a business in Korea'. I thought that professors should not be satisfied with doing good research and writing good theses. What could be better than that if you could see yourself transforming the world by commercializing the technology you developed? Existing universities have legacies in regards to this, so there are limitations. However, there's nothing like that in a new university.

Accomplishing this initiative won't be easy because it's a fresh start on the ground, but I thought I could accomplish anything with my passion and strong will. By the way, I also wanted to contribute to the creation of an organization full of positive energy."

Unlike research-oriented institutes of science and technology (KAIST, GIST, etc.), KENTECH has been built as a research-oriented and start-up company-oriented University. He is the leader of entrepreneurship education at KENTECH. If industry-University-research clusters and Energy Valley are activated, I am confident that KENTECH's Energy Valley will lead the energy transition of the world just as Stanford's Silicon Valley leads the digital transition of the world. However, on the other hand, various start-up activities and support should be provided so that KENTECH's talented people can be successful entrepreneurs. I was also curious about what kind of future he dreamed of through entrepreneurship education.

Mingyu Jeon is a freshman at KENTECH majoring in Energy Engineering, with a focus on Energy AI. He is a founding member of the KENTECH ESP Newspaper Club, and contributes to this newspaper by providing useful information regarding major events at KENTECH. His future goal is starting a business, due to the attractive nature of living a self-directed life. He hopes that solving problems can change the world.

Director Kwang-Hyon Kim

Q: What are your thoughts on being the head of KENTECH Industry-University Cooperation Center?

Director Kim: “I am packing one by one without rushing. As there are still only first-year undergraduates, the focus is on promoting entrepreneurship rather than direct support for start-ups. I let students meet a lot of people who are trying to change the world. Quarterly 'Challenger's Round Table', startup intern program, support to visit startup events such as COMEUP, Seoul startup tour program, etc. This year's field trip was mainly for graduate students, but next year, we plan to conduct the program for the business startup club as well.”

“Currently, I am focusing on supporting the start-up of instructors. Among the skills our professors possess, there are many good skills that can be commercialized. Currently, we are trying to commercialize in various ways, such as technology transfer and direct start-ups. It is undesirable for a professor to lead the company directly as the CEO of a start-up company. However, I want to make people say, “Starting a business is very easy in KENTECH”, I want to make many examples of students starting a business using professor’s technology, and I want to make many wonderful success stories.”

“There are quite a few energy-related companies in Naju, but they lack money, technology, and people. Now that KENTECH opened in Naju, it can be reborn as an ‘Energy Startup City’. The day will come when energy scholars from all over the world gather at KENTECH and have academic discussions. There will also come a day when our students start a business in Naju after graduating. At the time of creating a ‘KENTECH Cluster’ near the KENTECH and operating the ‘Energy Fund’, I think that Naju will be able to leap into a ‘Global Energy Capital’. I hope that the day will come when Korea and Naju will lead the ‘Great Energy Transformation’ around the world.”

KENTECH is also known for its innovative teaching methods. In addition to the AI class feedback system, the ALC system, we are aiming for student-centered education that excludes pretentiousness such as RC education and GAPA. In order to make good use of this innovative education system,

Director Kim recalled his college life and provided advice for college study and life.

Director Kim: “Four years of university is intellectual. It is a period of rapid growth in terms of both personality and intellect. You can learn a lot of the qualities necessary to become a company founder during this period. If you spend this period wisely, you will mature intellectually and your personality will also mature.”

“If you neglect to improve your qualities during your college days, you start your social life in a state of immaturity, both intellectually and in personality. Then you will not be happy and make people around you suffer. Imagine a kindergartener joining Samsung Group. Actually, a 37-year-old new employee joined a public company, and the next day the supervisor said he got a phone call from the employee's father saying: ‘What are you doing, not letting my daughter off work on-time?’ A founder is a person who has to constantly make decisions and take responsibility for those decisions day in and day out. A founder goes to work every morning praying with his whole heart: 'Don't ruin it today.' For your successful social life, four years of college is very precious.”

“I think it is a time for young people to develop their skills and develop their personalities and grow into leaders. You don't have to do it consciously. If you live fiercely, you'll grow up to be a good leader at some point.” KENTECH has many strengths as it aims to become a Strong and Small University. Above all, the biggest strength is that there are many opportunities for one-on-one conversations between professors and students. During the conversation, students can ask questions in detail and learn how to talk logically. I also often have one-on-one conversations with students, and I am often surprised. I think that students are much smarter than I was in college. Over the 4 years in KENTECH, I expect that KENTECH students will fiercely hone their skills, personality and grow into leaders who can be trusted and

Director Kim has worked hard to provide students with various opportunities such as Challenger’s Round Table and internships for students, and I understand that you have various plans to support start-ups, such as the KENTECH fund.

Q: What has been your feeling surrounding your first year at KENTECH, as an individual who worked hard to develop the entrepreneurship skills of KENTECH students?

Director Kim: “It's been almost a year since I came to Naju. In the meantime, I've been running while thinking about how to create a 'good university to start a business'. There were times when I was impatient because I wanted to get results quickly. But I worked with the idea of not rushing and building one by one. And it has been a very fun time. I especially enjoy hanging out with the students. It makes me feel great when I see motivated and confident students.”

Q: Studying and working are important, but you also need time to relax and recharge once in a while. What are your personal hobbies and interests outside of work?

Director Kim: “I think that in order to study properly, or to do a job properly, you have to be good at playing too. During the week, I am crazy about studying or work, and on the weekends, I take a break to recharge my positive energy. If I live with this kind of thinking, the world will be enjoyable and good results will come. After I came down to Naju, I tried to love everyone. I love myself, I love you, I love Namdo… So I created “Namsadang”, a faculty-staff club. If I had to classify it, it was a trekking club. A gathering of people who learn how to love and become one with nature while looking around Namdo's scenic spots, hiking, exploring restaurants, and looking for great cafes. Namsadang is aiming for this.”

“When students are in college, there are many things they have to do and many things they want to do. ‘I want to do this, I want to do that…’ Doing too many activities can lead to stress. Students need to choose a few hobbies that they like and focus on. I hope that students will engage in activities that will help them to train physically, broaden their knowledge, and deepen their thoughts. I want reading to become students’ daily routine, not just a hobby. They have to make reading a part of their daily life during four years of college so that they can live as an intelligent person even after entering society. By the way, I want you to keep in mind that time is precious. I want students to remember that they were selected as a commando member of the 'Earth Defense Corps'. If there are students who are doing 'part-timers' or 'tutoring', I want to tell them no to do that.”

Director Kim built a tremendous career, but he came to KENTECH without any preconditions because he sympathized with KENTECH's mission of transforming energy. Currently, he is providing students with valuable experiences such as Challenger’s Round Table, Startup Intern Program, Startup Event Program, and Seoul Startup Tour Program. Also, these days, professors are working hard on entrepreneurship. He is an accelerator and advisor who will give great power to the passion of young professors and students at KENTECH because he has experience in fostering numerous startups at D.CAMP and the KISED. In the future he thinks, he is dreaming of a future where conferences are held at KENTECH to discuss major energy transition agendas, such as the International Energy Forum, and countless foreigners shout “Cheers” near Bitgaram Lake Park. As much as his passion, the passion of the first students at KENTECH is so great that 1/3 of all students are active in entrepreneurship clubs. KENTECH's future is so exciting and anticipated!

INTERVIEW WITH PRESIDENT YOON

By **JIWOO JANG**

This November I had the opportunity to sit down and interview the Founding President of KENTECH, Dr. Euijoon Yoon, who put a spotlight on how KENTECH was founded. We spoke about the direction of KENTECH, and personal insights for incoming freshmen. Below is our interview:

My first question surrounded the founding of KENTECH. Our university is special and I believe is unlike any other universities in the world because of its focus on energy, the diverse roles of faculty, and the structure of the systems we have in place here; such as technologies for commercialization initiative.

Q: How did KENTECH come to be and what is your personal KENTECH story?

A: “While working in my first year as Dean of Research Affairs at Seoul National University, the head ‘KEPCO university task force’ visited me to get some advice on founding KENTECH. There were many negative opinions regarding founding a new university in Korea. He asked me to join as an auditor of the university, and I accepted. Later I was asked to apply to be the Founding President; however, I was in charge of research at Seoul National University, and I could not say yes to him. A few weeks later I got an email that I was among the ten finalists even though I did not apply for it. It asked me whether I wanted to remain in the list.

After carefully reviewing the KENTECH master foundation planI thought founding a new university would be truly meaningful work. I replied to the email that I would like to remain in the list. After several steps, I was on the shortlist with two other candidates, and then finally was chosen as the Founding President. I did not think that I would be selected; however I simply expressed my intentions to make an innovative university.”

Q: Don’t you think about the difficulties of being president?

A: I asked the President of Seoul National University what he would do if he was in the same situation as me, and he said it would be complex and difficult work, so he would not do it. Also, I heard that being the first president is really challenging. However, I finally decided to go for it and create a new university, and the ideas that I proposed have been well received thus far.”

Q: Now that you are the president of KENTECH, you work day in and day out to implement these ideas and put forth KENTECH’s vision. What does being the President mean to you?

A: “Fostering a university system and culture in the beginning holds an important meaning for me. KENTECH focuses on student-centered education that enhances the competence of students. When I recruit professors, they are all different. Even though they think student-centered education is good, they need to put forth great effort as an educator as well. During my term as President, maintaining this student-centered education will be an important keystone of KENTECH’s foundation. Also, building a good relationship between students, professors and staff members at KENTECH is very important .

A university should be an educational institution in the first place, not a research institution. Conducting research is to be good at educating and creating talented people. Therefore, the main focus of KENTECH is our students. The most important part as President is to lead the organization efficiently, and also give great effort to foster the ability of our students, and bring forth a personality that inspires teamwork.”

Q: As a KENTECH student, I can feel professors and students interact well and I can feel the president’s effort and see how focus is placed on the interaction between students and professors. How can we foster interactions between students and professors?

A: “There is a ‘triple advising’ system at KENTECH, where each individual student can talk about troubles they cannot solve themselves, and ultimately receive a customized education. Professors also offer the bridge program for beginners to reduce any information gap between students. KENTECH always listens to each student’s difficulties and tries to solve them. At KENTECH, an experienced advisor is never far away in a student's everyday campus life.”

Q: The challenges and balancing act of holding such a position with great responsibility is profound. However, I can imagine it is exciting and interesting as well. In your opinion, what are you most proud of thus far in KENTECH ‘s first year?

"Attempting everything is also one way of learning, and there’s no risk of failing as a student. Students should execute many experiments without fear and discover what they really want."

President Yoon's response when reflecting on the most important lessons he has learned throughout his career

A: Accepting excellent freshmen in the first year is something that I am most proud of. We passed these difficult first steps and displayed the fruits of our efforts for those who worked hard to found a new university. However, we live in an era where new energy is constantly changing and the world will need new energy experts soon. Majoring in fields of energy will be important, in addition, we must start out strong in the beginning by:

- Training researchers and entrepreneurs of the future
- Establishing the joint laboratory with Fraunhofer in hydrogen energy research, which demonstrates the potential of KENTECH.

Q: What projects or initiatives are you looking forward to the most?

A: Building national research infrastructure such as super-power laser centers and superconductivity research facilities for fusion energy. Also, for the results of research from KENTECHleading to start-ups, companies, corporate research institutes, joint research institutes, and collaborations with KEPCO. All of these initiatives are currently under way. Like Silicon Valley, creating a foundation for development is the role of the president.

Q: So many of these initiatives are ground breaking and require such advanced knowledge across so many fields. You earned your PhD from M.I.T; the best university in the world year after year. You also worked at Seoul National University for decades; the best university in Korea. What are the most important lessons you learned throughout your career?

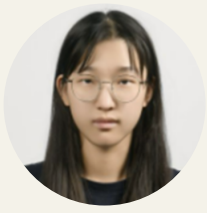
A: First, be ambitious, not shy. Even though someone may have great potential, many students are afraid of being wrong and failing; and these are big problems. Being more active and continually asking questions will improve your ability to succeed as a student. Attempting everything is also one way of learning, and there’s no risk of failing as a student. Students should execute many experiments without fear and discover what they really want.

The second lesson is to do more exercises. Campus life is not really easy and the amount of studying can be physically and mentally overwhelming. Removing stress by physical exercises and concentrating on work will be important. Lastly, making good friends is very important. We can use the Residential College program, and make various lifelong friends.

Q: What advice do you have for KENTECH incoming freshmen?

A: Come in and make your dream come true with us. The world will be different as time goes by, and there will be technological changes in energy unlike anything mankind has seen before. It will be important to become an energy expert at KENTECH and solve these challenging problems of the world."

I want to personally thank President Yoon for his time. We, as students, are lucky to have him leading us at KENTECH. I felt a lot of effort was involved in the making of KENTECH, and students should take advantage of various opportunities that KENTECH has. If we combine all of these opportunities together, we can absolutely become worldwide energy leaders.



Jiwoo Jang is a freshman of KENTECH majoring in Energy Engineering. She is a founding member of the KENTECH ESP Newspaper Club, and enjoys conducting interviews for the KENTECH ESP Newspaper Club. Students will come to KENTECH with their own goal, dream, or passion. She hopes everyone can achieve what they desire!

SUPERCONDUCTORS: THE KEY OF NUCLEAR FUSION

By **JAESEOK OH**

"A crude pile of black bricks and wooden timbers" - the response from Dr. Enrico Fermi; the man who designed Chicago Pile-1, the world's first nuclear fission reactor. Displayed under the University of Chicago's football team field in 1942, the whole world was first introduced to the concept of control and power that nuclear energy has.

As the history books tell us, humanity first used this awesome power as a weapon of mass destruction. The first nuclear fission bomb, "Trinity", came out during the W.W.II. The "Ground Zero" experiment showed the massive power of nuclear bomb. 6.16kg of plutonium-gallium alloy produced equal energy to 25,000,000kg of TNT. and the nuclear bomb named "Little boy" and "Fat man" are dropped to Japanese Empire's citizens to end the war. The army wasn't satisfied with it, so they tried to mimic the power of the Sun: nuclear fusion. And they succeeded. The U.S. made the first nuclear fusion bomb named "Ivy Mike". Ivy Mike, which had 10.4 MT of Energy, was 416 times stronger than the first fission bomb. The strongest fusion bomb, "Tsar Bomba".

Unless the military used it as a weapon, there were movements from activists that wanted to use this massive energy more peacefully, by using it to produce electricity. Nuclear fission power plants have been used since the 1950s. But no nuclear fusion power plant has been built until now. What's the matter?

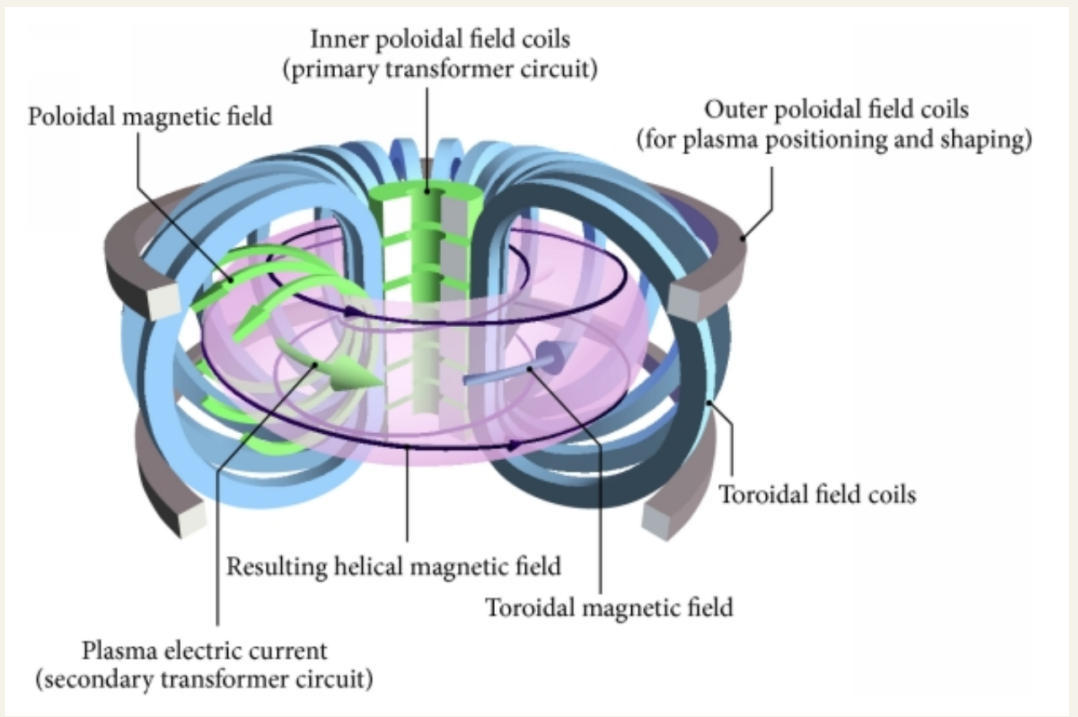
The biggest problem is, unlike nuclear fission, the atoms should be heated until about 100,000,000K to start the reaction. It is too hot, so that the atoms turn into plasma. For reference, Tungsten, which has the highest melting point until nowadays, melts at 3,695K. There is no material that can stand 100 million Kelvin at least on Earth. So the scientists found a new way to hold the hot atoms: the pinch effect. Some of you may have seen the lightning rods after it was hit by a thunderbolt. The high voltage on the rod creates strong magnetic fields, which causes the rod to shrink. It's called "the pinch effect".

Representative drawing of the first nuclear reactor

Tokamak and the Stellarator, which are the two main types of fusion reactor nowadays, differ at how they will "mix" the hot plasma, but both use pinch effect to control the hot plasma.

To enhance the control of plasma, the stronger electromagnet is essential. But if we apply more electricity to the common electromagnet, it creates heat because of its resistance, which eventually causes an electromagnet to break down.

Jaeseok Oh is a freshman at KENTECH majoring in Engineering. He leads the KENTECH Rocket club and has interests in nuclear energy. In his free-time he likes socializing with his friends and sipping on his favorite drink; Coca-Cola



Representative animation of a nuclear fusion reactor

This is why superconductors are being used in modern fusion reactors. Superconductors are materials that have 0 electrical resistance when the temperature is below the critical temperature of the material. Which means that we can apply a lot bigger electricity on the electromagnet, resulting in a stronger magnetic field.

There are lots of labs that study these superconductors. KENTECH, which is a new-born university specialized in energy technology in Korea, founded a lab named SUCCEX(Super Conducting Conductor EXperiment) for making next-gen superconductor based electromagnet, capable of 16 Tesla.

The development of stabilized nuclear fusion technology didn't come out until today, but its technology is still developing. The operation modes developed from L-mode to H-mode, and even FIRE-mode which was developed this year. With these brand-new technologies, nuclear fusion technology is expected to open the new era of energy.

Notes

"TNT equivalent(TNT 환산)", If a bomb produced 20t of energy is in reference to the bomb produced that has equal energy to 20t of TNT."

References

- E. Segrè, Enrico Fermi, physicist, Paperback ed., 2. [print.]. Chicago: Univ. of Chicago Press, 1995.
- S. Li, H. Jiang, Z. Ren, and C. Xu, "Optimal Tracking for a Divergent-Type Parabolic PDE System in Current Profile Control," Abstr. Appl. Anal., vol. 2014, pp. 1–8, 2014, doi: 10.1155/2014/940965.

ALL THE SMALL THINGS: SPOTLIGHT ON THE IN-SITU QUANTUM IMAGING LABORATORY WITH PROF. OH SANGHO

By **MINSEO PARK**

Assistant Editor

The research team of Professor Sang Ho Oh at KENTECH traces the dynamic motions of atoms, ions, and electrons in real-time with picometer precision during the energy generation and transfer processes using the state-of-the-art electron microscopy. This dynamic work reveals the inner workings of matter up close and personal.

Recently, his team observed the evaporation of the ZnO oxide surface in real-time and unveiled the origin of the rapid growth and evaporation of crystals in the c-axis direction. This study was co-authored by Zhen Wang, a doctoral student at Sungkyunkwan University, and Jinho Byun, a researcher at Pusan National University. unhyeok Bang, Professor at Chungbuk National University, Jaekwang Lee, Prof. at Pusan National University, and Sang Ho Oh, Prof. at KENTECH worked as co-corresponding authors.

Professor Oh SangHo

This work was published online on the 24th of September of this year in Nature Communications, an international academic journal of the highest caliber. The paper is titled: “Vacancy driven surface disorder catalyzes anisotropic evaporation of ZnO (0001) polar surface).”

Electron microscopy uses an electron beam which has a much shorter wavelength than that of visible light used for optical microscopes. There are different types of electron microscopy: SEM (Scanning Electron Microscopy) and TEM (Transmission Electron Microscopy). When the electron beam interacts with an inner shell electron of an atom, the inner shell electron is knocked out and escapes the sample, which corresponds to the secondary electron, a major source for imaging the sample surface. The vacancy due to the escape of the secondary electron is filled by a higher energy level electron. The energy difference between the two states is emitted as a characteristic X-ray. If the direction of the electron beam is changed without a significant change in the energy as a consequence of elastic scattering by the nucleus, the beam is deflected back out of the specimen, which is termed a backscattered electron. Those interactions of electron beams with atoms have different interaction volumes, escape depths. In the case of backscattered electrons the interactions are strongly dependent on atomic number, so its image contrast can deliver the chemical composition of the sample.

SEM scans the surface with a beam of electrons and provides information on surface topography and chemical composition. On the other hand, TEM uses transmitted electron beams through a thin specimen. Elastically scattered electrons form a diffraction pattern as a consequence of constructive interference at the back focal point of the objective lens. Since the diffraction spots are due to constructive interference of specific crystal planes, the crystal structure can be obtained by analyzing the diffraction pattern.

I had the opportunity to sit down with Professor Oh and discuss his current research and groundbreaking discoveries.

Minseo Park is a freshman at KENTECH majoring in Energy Engineering. Her goal in the KENTECH ESP Newspaper Club is to provide readers with current events at KENTECH. She feels that it is great to study at KENTECH and solve future energy problems. She hopes to meet more talented people here soon.

Q: Why did you use EELS and EDS both to reveal the composition of the quasi-liquid layer forming on the surface of ZnO?

A: “TEM obtains chemical compositions, and the methods are largely divided into EDS (Energy Dispersive X-ray Spectroscopy) and EELS (Electron Energy Loss Spectroscopy). EDS detects the energy of characteristic X-rays but this detection could be hard in the case of light elements. On the other hand, EELS detects the components by measuring the energy loss of electrons as they pass through the sample due to the inelastic collision. Both methods can verify and EDS can be supplemented by EELS, so we used both when estimating the composition ratio in a quasi-liquid layer.”

Q: What attracts you to study electron microscopy?

A: “To me electron microscopy is not a tool just for observing what has happened, but an imaging laboratory that reveals mechanisms through experiments. It requires a high level and continuous study for the developing solid foundation. All areas of knowledge such as physics, optics, crystallography, and diffraction are integrated into electron microscopy and a high level of electron optics is required to design electromagnetic lenses and spherical aberration correctors. Recently, as the need for atomic-level observation increases in fields such as semiconductors, Li-ion batteries, and solar cells, big data are collected and machine learning-based analyses are being developed. I consider myself very fortunate to have a chance to study electron microscopy.”

Q: Can you share your experiences in your research career?

A: “I was greatly impressed by casual but highly in-depth discussion while studying at the Max-Planck-Institut fur Metallforschung in Germany as a postdoctoral researcher. This is because in the process of exchanging feedback with others and explaining my own opinions, I have firmly established my fundamental knowledge and broadened my view of research. Later, I performed government-funded projects at the Korea Research Institute of Standards and Science (KRISS). However, I pursued intellectual pleasure through basic research, so I applied to the Erich Schmid Institute of Material Science Austria. I considered settling down in the US, but I returned because I wanted to create an ideal research group in Korea.”

Q: Your lab published 15 papers in 2022 and 12 papers in 2021. How can you publish qualitative articles often?

A: “The papers currently being published are not written in a short time, but the programs that have been pursued for 4 to 5 years at Sungkyunkwan University are now bearing fruit. I want to grow as a scientist and give a good influence on all graduate students in my lab, so I have two-hour in-depth individual meetings with every student a week and active communication.”

Q: What is the ultimate goal of your lab?

A: “Each student may have their own goals and visions, but in our lab, I want to nurture students who will grow up as scientists. I hope you will also experience the culture of leading groups and broaden your perspective in your career.”

It was an honor to meet Prof. Oh and he did his best to explain his article to me. I hope this interview could lead to your interest in the atomic world and Prof. Oh's lab. Thank him for sharing his experience candidly with the students.

MOKPO: THE FIRST DESTINATION FOR YOUR TRAVELS IN JEOLLANAM-DO

By **HYEONSEO JANG**

Nighttime view of Mokpo

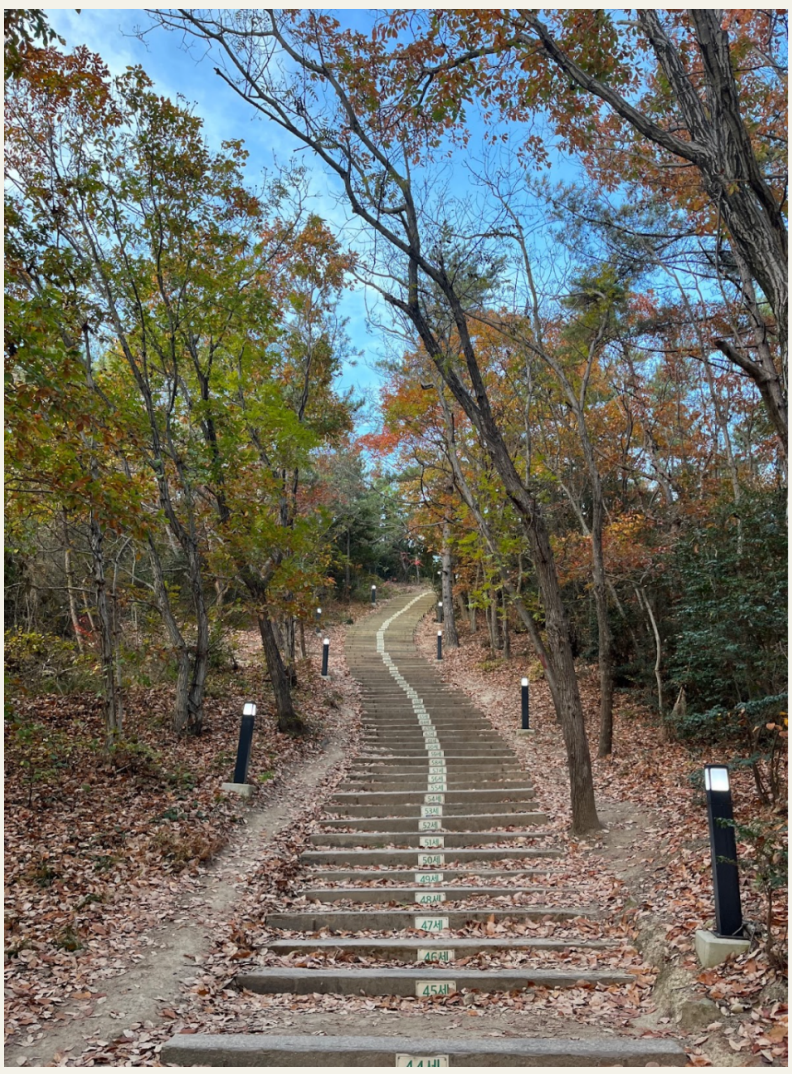
Traveling is one of the best things you can do in Naju. People can see beautiful sights and eat delicious foods in places they have never been to before. Going traveling also helps people to make their mind solid again, refreshing their mind and soul. The students have time, money, and friends at KENTECH, which are the best conditions for traveling. This article introduces Mokpo as an ideal destination for students looking to escape for a short trip.

HISTORY

As people know, Mokpo is one of the biggest cities in Jeollanam-do. Since it has been developed for ages, travelers can find some antique places in Mokpo. The antique places they can find are usually built in the Japanese colonial era and after Korean independence.

Nearby the Yudal mountain, travelers can find buildings built in the Japanese colonial era. The buildings are located near the Mokpo Modern History Museum. Travelers can visit the museum and walk through the street feeling the past. They can also find some cafés using modified Japanese buildings. The museum fee is 2,000 won and the cost of buying coffee from a café (행복을 부르는 집) is about 6,000 won.

The museum opens from 9 AM to 6 PM. If a traveler is interested in the place where normal people lived in the past, he can visit Sihwa-street, which was the filming site of the movie 1987. There are old houses and some poetries which were written by grannies. The drawing on the wall adds affection to the passengers' minds. Walking the street, travelers would feel affection and quietness.



One of the many hiking destinations available to travelers in Mokpo

THE SIGHTS

Mokpo is a port city. This means there are seas and islands travelers can enjoy. In Mokpo, the longest cable car, which takes about 40 minutes to make a round trip, runs daily. The cable car goes through mountains and over the sea. Taking the cable car, travelers can see Yudal mountain, islands on the sea, and the urban landscape. It is an attractive experience to stand over the sea.

One of the many 'hidden gem' restaurants in Mokpo that sell local delicacies

Taking the cable car, travelers can reach Goha-island and Yudal mountain observatory. They can get hiking and take a short walk on Goha-island watching the sea and the city. There is a path on the sea following the side of the island. The walkers can hear the waves between the car sounds and cable car machine sounds. On the island, there are trails people can walk through too. If one takes a walk halfway, reaching the observatory, it will take about one hour.

Watching the islands and sea, travelers can feel refreshed. Tasting the sea wind, the whole mind fills with the wind washing out distractions.

If travelers take the cable car at night, they could see the night view of Mokpo. Although there are not many skyscrapers, the small houses glow to brighten the sky. The lights in Goha-island and the pillars of the cable car also make their own night view. The cable car fee is 22,000 round trip, for a normal car. The fee for a crystal car, whose floor is transparent, is 27,000 won. The cable car runs from 9 to 8 in winter, while it normally runs from 9 AM to 9 PM.

THE SHOWS

In the new downtown, there is Mokpo Culture and Art Center and the W show. The center holds several shows for Mokpo citizens. The visitors can check the schedule on the website. The travelers can also see the W show near the sea. The W show includes fireworks, singing, and dances. The show is held on the stage on the sea. The show performs on Saturdays from September to November. It starts at 8 PM. Travelers can see the show on the internet through the website.

THE FOOD

Mokpo is one of the cities in Jeolla-do, which is the region of taste. The food of Mokpo always satisfies travelers. Sukule is one of the traditional foods of Mokpo, which is made of mugwort, grain syrup, adzuki beans, and rice cake. It is served with a metal container whose color is gold. It doesn't taste that sweet, a little potato or adzuki beans, and mugwort. Travelers can find Sukule near the station. It costs about 5,500 won.

The second food is bread. Mokpo has one of the top three bakeries in Korea, the Korombang Bakery. The bakery is famous for shrimp cream baguettes and cream cheese baguettes. The taste of the shrimp cream baguette is similar to the shrimp cracker, but with a stronger scent, and the texture feels a little like the intestines in the shell of the steamed crab. The bakery bakes the baguette from 8:30 AM to 8 PM constantly. The cost of a baguette is 5,000 won.

There is a CLB bakery near the Korombang bakery, which was the same bakery in the past. Although the costs of baguettes are different, they sell the same baguette. CLB bakery sells for 6,000 won, and bakes the baguette from 8 AM until the store closes. There are branches of CLB bakery at the cable car stations, which take the baked bread from the head shop.

The New Free Market, which is the traditional market of Mokpo, has two famous kinds of bread. Twisted bread and ugly bread (못난이빵) are there names. The twisted bread of Mokpo has turmeric, which tastes like a little curry. The shape of ugly bread is diverse, which made the name of the bread. The bread is made with plain bread with sugar

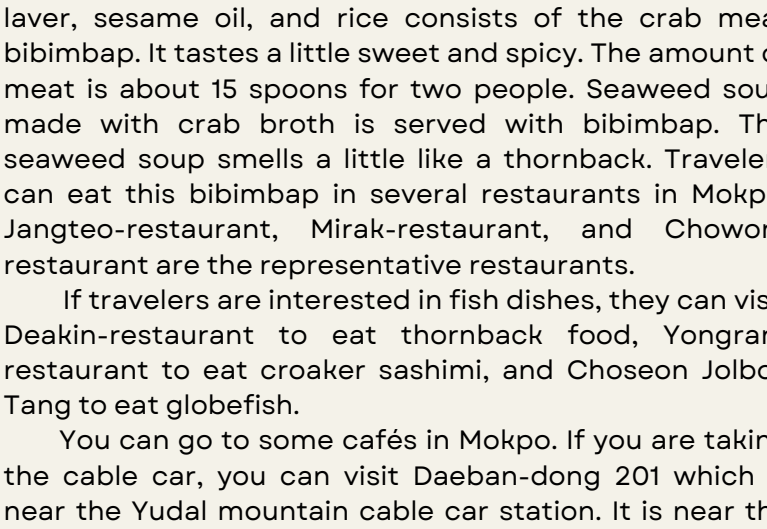
Jeollanam-do is famous for Baekban, a meal with a bowl of rice, soup, and side dishes. You can visit the Baekban street in Mokpo, where the restaurants serving Baekban are located. Baekban has a light and clean taste. Since it is very similar to the food that Korean people eat at their home, Korean travelers feel comfortable eating it. The representative restaurants are Doljip, Baekjeong-restaurant, Namkyung Baekban.

One of the famous foods of Mokpo is crab meat bibimbap. I personally visited a Chowon-restaurant near the station. The meat of spicy marinated crab, dried laver, sesame oil, and rice consists of the crab meat bibimbap. It tastes a little sweet and spicy. The amount of meat is about 15 spoons for two people. Seaweed soup made with crab broth is served with bibimbap. The seaweed soup smells a little like a thornback. Travelers can eat this bibimbap in several restaurants in Mokpo. Jangteo-restaurant, Mirak-restaurant, and Chowon-restaurant are the representative restaurants.

If travelers are interested in fish dishes, they can visit Deakin-restaurant to eat thornback food, Yongran-restaurant to eat croaker sashimi, and Choseon Jolbok Tang to eat globefish.

You can go to some cafés in Mokpo. If you are taking the cable car, you can visit Daeban-dong 201 which is near the Yudal mountain cable car station. It is near the sea, which makes the customers enjoy the view. If a traveler is waiting to watch the W show, he can visit Coffee-changgoro, which is nearby the site of the show. The egg tart of the café is famous. If a traveler is near the modern history museum, s/he can visit 행복을 부르는 집, which is famous for its antique building and furniture.

Mokpo is one of the destinations KENTECH people can easily visit by train. It has a stunning landscape, delicious foods, and historical spaces, which are the objects travelers want to find in their travels. Additionally, since the sites are close by, travelers can walk to move. Therefore, the KENTECH news club recommends students to visit Mokpo as the first destination of their travels.



References

The Above photo is of 'Dragon Tail's Island' - All information presented in this article was either taken from first-hand experiences or from various blogs. Almost all of the information on restaurants in this article were taken from first-hand accounts by interviewing local taxi drivers in Mokpo. Additional information on bakeries were obtained by interviews with the employees. Information for the W show was obtained from the website of Mokpo city hall (http://mokpowshow.co.kr). Additional information can be found from the Mokpo city hall website (https://www.mokpo.go.kr/tour).

Hyeonseo Yang is a freshmen at KENTECH, majoring in Energy Engineering. He is one of the founding ESP Newspaper Club members. He is focused on writing articles related to the travel of those in the KENTECH community. He obtains his accurate information by interacting with people in the destination topic of each article he writes.

CONCERT REVIEW: IU'S LATEST PERFORMANCE

By **CHANJU PARK**
Assistant Editor

Have you ever searched for a thrilling event when life gets monotonous and repetitive? Going to a concert would be a great experience and it might give your life a boost. A few KENTECH students went to IU's recent concert in Seoul on September 17th and 18th. For those who may not know, IU is a Korean vocalist with numerous hit albums including "Palette", "Love poem", and "LILAC". She's famous for her catchy and melodic songs and touching lyrics. The concert, Golden Hour, was a success, receiving rave reviews for excellent live performances. Attending a concert like this is a once in a lifetime experience for many, therefore I interviewed students who went to the show and gathered their recollections of this unforgettable experience. Let's check out what they had to say:

Students described their overall impression with an outpour of emotions. "SH" described their general impressions of IU's Golden Hour performance in a few words:

SH: "[it was] a fantastic reunion. I've been attending the IU concert almost every year since I was 13 years old, but I couldn't go from 2020 to last year due to the covid. I'd say I had a great year at the age of 20 just for the recollection of this concert."

Student "MS" had a much more passionate experience, saying:

MS: "It was like a beautiful dream. That was how unrealistic I felt. I hadn't gone to a concert in a long time, so I was amazed by the heat of the concert. IU had the best live vocals on stage, and I could hear her chuckling through the mic, which showed that she was singing live. I didn't feel real when it ended since the talking time was limited and the music flew by so quickly. I finally realized it was over when I arrived at the hotel and talked to my friend."

Finally, "WT" described their experience as: "comfort." They went on to say:

WT: "we couldn't even imagine going to a concert and singing together during COVID-19, therefore it soothed me for having a hard time so far from the covid."

One of the various stages at the IU concert in Seoul

Student "HD" simply said, "It was a legend."

IU is well known to be a unique performer with a live band and frequent interactions with those in the audience. Many attendees reported that the live band background instrument was excellent, and the stage set design was also said to be awesome. Moreover, students had their own favorite part of the concert.

"SH" referenced her favorite thing about the Golden Hour in the following way:

SH: "I sat in the middle of the second floor on the first day, and the staging, firecrackers, and drone performances were as if I were in heaven. On the second day, I sat on the first floor's left side, near the hot air balloon that IU rode. I believe IU saw me three times [chuckle]. The live band was great, and even an orchestra was there to play live."

"MS" provided more insight into the exact songs performed, saying:

An IU souvenir light-up microphone

MS: “The first song, "Eight," was fantastic. The lively talk of the crowd and the golden sky over their heads told me that everything was ready before the event began. I also felt a thrill when I heard the singer's voice without instruments. We were under the shade of an orange sun. This single sentence is summarizing the entire situation. It was also my first live performance of the last stage, ‘The Sea’, and it was soothing and touching. I had never imagined that the moon of “Strawberry Moon”, the sun of “Eight”, the sea of “My Sea”, and the waves of “Ah puh” would be connected and make a story. The red moon after the sun goes down felt like a metaphor of falling in love, and a child who had her sea inside her mind has become a relaxed and solid person who enjoys surfing even in the big waves.”

Student “HD” said about the opening song as well, saying

HD: “It's difficult to pick just one thing that I loved best. But should I have to pick one, it would be the first phrase IU sang without an instrument in the beginning. Many people were moved to tears after hearing that, but I kept my calm to concentrate on the performance.”

With the above students raving about IU’s performance, student

“WT” really puts it nicely by simply saying:

WT: “the best part was that I could listen to my favorite artist's music and see her with my own eyes.”

How to plan your trip?

If you’re planning to go to a concert, I want to mention some tips you might find helpful in your journey. I asked SH the following:

Q: “It's a long journey from Naju to Seoul. I'm guessing you considered many routes to Seoul and picked the best one. How did you go from Naju to Seoul?”.

SH: “On Friday, I asked my physics professor for permission and then left the building at 5 p.m. Then I drove to Naju station in the car. I bought a 내일로 pass and paid a decent fare to use ITX to Yongsan Station.”

MS: “The express bus runs from Naju Express Bus Terminal to Central three times a day, but it usually takes more than four hours and is tiring, so I took the KTX train. Goods and lightsticks are sold from the morning of the concert day, so it is better to go early rather than at an exact time. I came back to Naju at 7 am the next morning.”

WT: “Since the performance was at Jamsil Sports Complex, I took the train from Naju to Yongsan and then the subway to Jamsil.”

HD: “Friday afternoon, I traveled to Seoul listening to a Minerva session on KTX (For those who don’t know about Minerva class, it’s held online via the Minerva platform). I stayed near Jamsil in order to be close to the concert hall.”

Pro-Tips

In general, most students simply want to know the most important general tips for attending concerts such as these. Those who went, said the following:

- Memorize the fan chant in advance if you want to cheer with the music. You’ll need a portable battery or a bag. Move before the transfer time. I would have paid 1,000 won if I had transferred, but I ended up paying 3,000 won, said “SH”.
- In my opinion, the finest place to enjoy the concert was at the front of the concert hall. On each side, it is difficult to view the performer and you might just look at the screen the whole time. Therefore I recommend booking a seat in the middle of the show. Other than that, you won't be able to re-enter once you go in, so pack water and everything with you, said “WT”.
- No matter which concert you go to, an umbrella is a must. You’ll have to line up outside for a very long time. If you want to preserve your hair from escaping from the scalp due to UV radiation, bring an umbrella or parasol to protect yourself. Don't let your guard down just because it's winter, said “HD”.

Ticketing Tips from "MS":

In the case of IU, she tends to open exclusive ticketing on Melon. The page will change automatically so that you can open the next page if you DON’T reload the page. Internet speed is the most important thing. You can see the available seats just by entering early. After entering, you need to enter a security number. I recommended entering it first. You might type it later and lose the seat. When you choose a seat, you should not bite off more than you can chew and choose the best seat or you will see this message: “This seat is already taken.”, and you will definitely fail. Deposit without a bankbook and send the money right away. Get an early morning cancellation ticket if you fail to get a ticket at the first chance.

Finally, budget is one of the important parts of a plan. Students highlight their key information below:

SH: “about 550,000 won in total. - two concert tickets: 300,000 won, goods: 160,000 won, and transportation fee: 80,000 won.”

MS: “Train ticket: 90,000 won, VIP concert ticket: 166,000 won, and the accommodation fee, etc.”

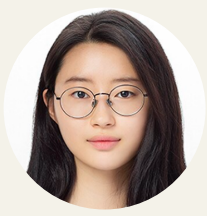
WT: “If you go from Naju, there is a KTX travel package that enables you to ride KTX twice in two days for 60,000 won, so I could save on transportation costs. Furthermore, the concert ticket was 160,000 won, and eating snacks or meals cost roughly 30,000 won.”

HD: “I budgeted about 500,000 won to buy MD goods... I didn't think I'd spend more than that. However, the goods were very special and ended up going over budget, spending 1 million won total.”

In summary, “MS” expresses an important concern for those you may go to an IU concert in the future:

MS: “you may be hesitant due to financial constraints, but the concert you did not go to might be the best concert ever, and an artist who actively releases songs may not perform past songs at the next concert, so it could be your final chance to hear them live. The show is only one day, but I get a second wind while waiting for the day after buying the tickets. The memories of the performances will last forever, and you'll probably look forward to coming to another concert the next time. You can go for once, and if you don't like it, just don't go again. It's nice to have new experiences, isn’t it?”

After hearing these stories, I believe that experiencing a concert like this would be both thrilling and meaningful. Stay updated on the upcoming concert schedules of your favorite musicians. I'll cross my fingers for you when buying tickets! For those who do not want to travel far, KENTECH’s university band, where I am the lead vocalist, is always practicing. Please keep an eye out for our next performance.



Chanju Park is a freshman at KENTECH studying AI and Chemistry. She enjoys doing research, reading books, and listening to music. She hopes to entertain you with stories about anything that comes to her mind.

SPOTLIGHT ON KENTECH'S ENGLISH FOR SPECIFIC PURPOSES PROGRAM

Here at KENTECH, we offer a custom designed program for English education called: The ESP (English for Specific Purposes) Program. Our program aims to enhance the capacity of engineering students from diverse backgrounds to write and speak in English. Students are assigned to four different levels of English to acquire the skills and knowledge essential when using English language communication in academic settings.

KENTECH ESP courses focus on exploring the ways in which English can be used as a creative resource for presenting information; structuring texts; expressing points of view; developing arguments; incorporating alternate ideas and voices; and addressing audiences in scientific texts.

KENTECH ESP's underlying philosophy is that writing is an indispensable tool for cultivating scientific habits of mind. Scientific writing, in particular, contains unique linguistic features that construe special realms of scientific knowledge, values, and beliefs. An understanding of the functionality of these features is critical to the development of literacy in science and engineering.

All ESP courses are integrated into our Energy course curriculum and instruction in order to cultivate habits of mind that reflect how experts think, communicate, and practice in the global community of science and engineering. In order to boost student learning, KENTECH ESP also offers intensive 1:1 tutorials sessions designed to address individual needs of students.

<KENTECH ESP COURSES FOR EACH LEVEL>

Level	Courses	Required /Elective	Focus
4	Writing for Publication Purposes Professional Communication	Elective	Writing an Empirical Research Article ESP Professional Preparation
3	ESP Advanced Writing ESP Advanced Speaking	Required	Writing Academic Genres Scholarly Communication
2	ESP Intermediate Writing ESP Intermediate Speaking	Required	Academic Language: Skills and Strategies
1	ESP Foundation II ESP Foundation I	Required	Science Genre Awareness: The Language of Science and Engineering

If you have any questions about our ESP education curriculum, please contact:

Dr. Jungyoung Park
Director of KENTECH ESP Education
Assistant Professor
Language and Literacy Education
Department of Energy Engineering

jypark@kentech.ac.kr

NOTE FROM THE EDITOR

I am delighted to report that the first issue from The KENTECH's ESP Newspaper Club has been a great success. Our first issue contains an excellent mix of interviews, reviews, and dialogues spanning a wide range of topics contributed by a great and dedicated group of students. The inaugural KENTECH ESP Newspaper Club is a student-led group and all articles written here represent each individual student's voice and articulate their passions and interests through their own eyes.

Topics chosen in this issue are meant to share the dynamic nature of KENTECH and the projects, and initiatives underway. Our front-page article showcases the groundbreaking connection between KENTECH and Fraunhofer and spearheads our international presence throughout the world. Additionally, our article with the director of the Industry-University Cooperation highlights one of KENTECH's major initiatives - where students and faculty create start-up businesses and grow our University and surrounding area into a technological juggernaut in the energy fields. Our up-close and personal interview with Professor Sangho Oh presents the caliber of our faculty members and displays one strong example of KENTECH's cutting edge research and state-of the art facilities. Finally, our travel and concert reviews remind us that life on campus is not always academic, and are excellent examples of the unique personalities our students have.

We want to thank you for taking the time to read our newspaper and hope you have the time to join us for our next issue.

George C. Kamenos, M.Sc
Clinical Assistant Professor
English for Specific/Scientific Purposes
Department of Energy Engineering
Korea Institute of Energy Technology

Acknowledgements

Thank you to all student participants and their dedication this semester, we also want to thank all interviewees for their time. Additionally, we would like to thank the Editorial Advisory Group **(Professor Jungyoung Park and Jennifer Manning)** for reviewing our final product and all administrators and staff involved in ESP clubs this semester. We could not have done it without you!