

The logo features the acronym 'IAE' in a large, blue, serif font. Below it, the full name 'Institute for Advanced Engineering' is written in a smaller, blue, sans-serif font. The text is centered and surrounded by abstract geometric shapes in shades of blue and purple. A network of dotted lines with small circular nodes connects various points across the page, creating a technical or engineering aesthetic.

# IAE

**Institute for Advanced Engineering**

# Research Institute creating practical values of technologies

## **Institute for Advanced Engineering**

The IAE (Institute for Advanced Engineering) is an academy-industry-institute collaboration complex as well as a research association of industrial technologies, which is established by the Act on the Support of Industrial Technology Research Association. It aims for the introduction and distribution of advanced technologies and R&D in the field of industrial technologies.

The IAE is a non-profit research institution carrying forward more than 100 project-based-system(PBS) cooperation every year with its association member companies, small and medium-sized enterprises, universities, and contributed research institutes. It studies on what the business practically needs through facility sharing and joint research and diffuses advanced technologies to foster 'Small-Gant' companies. It also contributes to the improvement of enterprises' industrial competitive power by forging mid- and long-term coexistent research collaboration networks.

The IAE has played a leading role in studying the field of coal · waste · biomass gasification and energization, waste recycling, rare metal recovery and is strengthening the R&D and technological power of hydrogen and wind energy, IoT based robot systems, and high precision manufacture · measurement · drive systems utilizing the FTS, which are in the spotlight as the technologies for the future generation and the foundation of the fourth industrial revolution. Especially, it is the IGCC (Integrated Gasification Combined Cycle) that the IAE has studied for more than 20 years since 1992 when it was established.

The IAE will be a world-class research institute through unceasingly striving to develop not only demand-side pragmatic technologies which the business world can use but also cutting-edge ones to solve our socio-economic problems and secure national competitiveness.

President **Jin Kyun Kim**





# IAE 2022 VISION

Research Institute self-growing with customers by creation and convergence of **technologies and creation of practical value of technologies**

## Strategic Directions

Securing the driving force for the future growth

### Core values

Creativity · Challenge · Passion

Deepening and expansion of core technologies

### Core values

Excellence and Pragmatism

The effective management of the organization

### Core values

Personal empowerment and customer satisfaction

## Technological Excellence and Pragmatism

**Excellence** The increase of the national industrial competitiveness through developing superior technologies for the growth into a better institute and a better individual with constant challenges and creative thinking

**Pragmatism** The provision of useful values for the IAE and customers through the industrially available technologies and technology transfer, which reflect the needs of customers

## Creation, Challenge, Passion

**Creativity and Challenge** For the sustainable growth and development in a rapidly changing environment, the adaptation to the change and breaking away from stereotypes are required. The pursuit of the industry-oriented development through cooperation with domestic and foreign research institutes and enterprises, and that of an open-minded institute actively accepting and utilizing superior technologies of other public or private research organizations

**Passion** The willingness of chasing the primacy with positive thinking and proactive behavior. the ownership and responsibility with grit and tenacity

## Personal empowerment and customer satisfaction

**Strengthening competency** Recognizing that a key source of value creation is members and their capabilities enhanced through constant self-innovation. For members having self-esteem and happiness with an open and balanced mind in work and everyday life

**Customer satisfaction** Research activities with professionalism and accountability, and acquisition of customers' trust through fulfillment of promise

## 1992~1999

- 1992.07.07. The IAE established(Seoul)
- 1994.08. Ajou University branch established(IGCC research)
- 1995.03. Integrated Gasification Combined Cycle System(IGCC) BSU built (Ajou University)
- 1995.11. YongIn Research Center established(the IAE relocation)
- 1998.07. Project Based System(PBS) introduced and operated
- 1999.09. Two research teams including Plasma designated as National Research Laboratories(Ministry of Science and Technology)

## 2000~2009

- 2000.06. Four research teams including Gasification Melting designated as National Research Laboratories(Ministry of Science and Technology)
- 2000.07. Business Incubator designated(SMBA)
- 2001.08. Three research teams including Precision Technologies designated as National Research Laboratories(Ministry of Science and Technology)
- 2002.05. An institution for the calculation of labor costs designated by the governmental R&D project (Ministry of Science and Technology)
- 2003.03. An institution for the calculation of labor costs designated by the governmental R&D project (Ministry of Commerce)
- 2004.04. ISO 9001: 2000 Quality Management System Certificate obtained
- 2006.02. Affiliation with the Components Integration Research Group supporting SMEs
- 2009.07. MOU for the development of clean coal technology (Ministry of Knowledge Economy, POSCO, SK Energy, etc.)

## 2010~2019

- 2010.06. Synthetic natural gas (SNG) manufacturing process BSU Built
- 2010.09. Waste recycling and rare metal recovery technology development launched
- 2011.10. Natural gas(LNG) manufacturing process BSU built
- 2011.02. 20ton/day IGCC Test-Bed construction launched(~2016)
- 2012.03. Materials processing center(Resource Recycling) established
- 2012.11. The Pilot Plant of Waste Gasification Melting System built
- 2013.04. Rare Metal Industrial Technology Research Center(Incheon-Songdo TP) established
- 2014.02. IGCC BSU moved into the IAE
- 2014.03. IAE VISION 2022 planned
- 2014.06. The Supercritical CO2 Power System Promotion Division established
- 2015.05. Running of task force teams for technology convergence and innovative human resources
- 2015.06. Launch of developing strategic industrial materials (TiCl4, TiO2)
- 2016.07. Launch of engineering design for the Supercritical CO2 Power Generation System
- 2017.08. Generic technologies of System Engineering and the launch of wind power generation related technologies
- 2018.07. R&D on liquified air storage/utilization and CO2 capture/utilization (ESS & CCUS)

# Plant Engineering Center

The Plant Engineering Center leads the differentiated technology development based on its R&D and core engineering capability in the field of energy and the environment. It especially provides the total service of plant business from a feasibility assessment to a Process Design Package and from Core fundamental technology development development to Practical core technology development .



## Energy Conversion Technology

- Pyrolysis technology
- Coal / cokes gasification technology
- Biomass / waste gasification technology
- Incineration / combustion technology



## New Renewable Energy

- Technology of Optimal Micro-siting for Wind Power Plants
- Technology of Load analysis for Wind Power System
- Design Technology of Wind Power Control System
- Design Technology of Floating Offshore Wind Turbine System



## Production, storage and transportation technology of Hydrogen energy

- Biological hydrogen production technology
- Technology of hydrogen production from liquid fuel and natural gas
- Technology of hydrogen production from plasma
- Technology of hydrogen production from biomass gasification



## Knowledge Based Engineering Technology

- Evaluation of economic feasibility for plant
- Plant process analysis technology
- Plant modulization technology
- Analysis technology on the risks and availability of plant



## Air Pollution Control Technology

- Fine particulate matter control technology
- Nitrogen oxides control technology
- Sulfur oxides control technology
- Nuclear reactor exhaust system designing technology

## Plant Process Development Center

Plant Process Development Center is conducting the development of optimization technologies for the overall and unit processes from low-grade fuel supply to syngas production and application. The technologies pursuit the continuous stable operation of gasification systems using various low-grade fuels, such as coal, petroleum coke, biomass, etc.



### Design and operation technologies of integrated process for hydrogen production and hydrogen complex stations

- Design engineering technologies of integrated process for hydrogen complex stations based on CAE
- Verification and running control technologies for hydrogen complex stations



### Continuous high-pressure powder feeding technologies

- Continuous feeding technologies of atmospheric powder into high-pressure reactor replacing lock-hopper systems



### High value technologies using molten slags

- Geopolymer conversion technologies utilizing molten slags
- Filtering media for rainwater treatment
- Bulding bricks



### HYBRID PTFE(Polytetrafluoroethylene) membrane filter technologies

- Absorbent coating PTFE membrane filter technologies for simultaneous removal of fine particles and heavy metal(Hg)



### Syngas production technologies through low-grade fuel gasification

- System optimization technologies based on various low-grade fuels
- Operation control technologies for producing high quality syngas

## Bio Resource Center

Bio Resources Recycling Center has conducted researches on circulating waste resources into useful ones for the sustainable development of the future society. The main research areas are organic waste-based biomass, energy production, useful resources recovery and reuse of the waste water, and recovering hydrocarbons in the atmosphere. The team is developing core technologies to implement the future of zero carbon society through the fusion of materials and plants, integration of unit technologies, and ensuring commercially viable economic feasibility.



### Energy production from organic waste biomass and its application

- Integrated plant based on hydrothermal carbonization for the production of solid refuse fuel (SRF) and biogas
- Biomass application processes to improve economic feasibility



### Reuse of wastewater and recovery for valuable resources

- The refractory wastewater treatment and reuse by connecting electrochemical oxidation with bio-membrane
- Sterilization system for the reuse of hypersaline water from food factories



### Upgrading adsorbents and its application of volatile organic compounds (VOCs) recovery

- Upgrading carbon materials with high surface area as high as 2,500 m<sup>2</sup>/g
- Recovery and energization of volatile organic compounds (VOCs) by ad-/desorption processes using adsorbents with high surface area



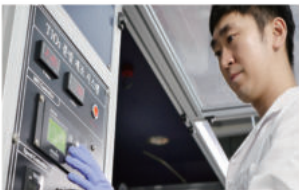
# Materials Science and Chemical Engineering Center

Material Science and Chemical Engineering Center aims for the technological convergence to improve industrial values of technologies such as resource recycling and purification, and functional material production in diverse applications. The center is especially focused on the development of the cutting-edge of advanced material technology to support the progress in domestic technology. The center also provides customized research and technologies for small and medium enterprises, and advises them to successfully achieve the technology commercialization by integrating expertise in physics, chemistry, metals, materials etc.



## Valuable resources separation/recovery and up-cycling technology

- High efficiency pretreatment technology for by-products and used products
- Recovery technology of valuable resources from waste resources via dry/wet methods
- Up-cycling technology of valuable resources



## Fabrication technology of high-performance industrial materials

- Technique for synthesis of polymer dispersed aqueous solution
- Technique for synthesis of lithium-based and an active material for lithium ion battery
- Technique for synthesis and purification of  $TiCl_4$  for industrial raw materials



## Synthesis and purification technologies of refractory metals (Ta, W, Ti, etc.)

- Nanoparticle production technology from ilmenite to titanium dioxide
- Titanium dioxide nanostructure production technology based on wet process method



## Synthesis of nanoparticles and surface-coating technologies

- Synthesis technology of various metal and semiconducting nanoparticles
- Surface-coating techniques for the improvement of functionality
- Technique of surface treatment for nanoparticles using organic/inorganic materials



## Fabrication of composite materials and special molds design

- Properties evaluation technologies of various types of carbon fiber and fabric
- Layered fabric and fast-curing resins synthesis technologies
- Fiber draping and resin flow analysis technologies



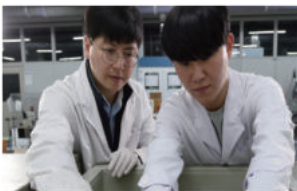
## Center for Advanced Materials & Processing

Advanced Materials and Processes Center studies on components materials for energy/environment fields, organic/inorganic materials such as metal, ceramic, polymer, the recycling processes and materialization of valuable wastes resources ,etc. The center seeks the development of fundamental technologies and brings the technologies into practical uses in the field of alloy and advanced material manufacturing processes for intensified competitiveness and sophisticated materials through functional component materials, value-added materialization, and valuable metal recycling technologies. It specializes in powder, such as copper(Cu) alloy, light metals, energy storage, shape memory alloy, aero-materials, etc. and additionally conducts researches on the recovery of highly efficient useful resources and the added value enhancement of reusable materials. Based on these technologies and experiences, the center is conducting academy-industry-institute collaboration and research and business development(R&BD) projects with various experts from the government, corporations, and universities.



### Design of functional materials and property optimization

- Advanced Material design and property modification of powder manufacturing, light metal, energy storage, shape memory alloy, aircraft materials, etc.



### Organic/inorganic composite materials and surface treatment technologies

- Nano materials, nonferrous metals refining, metal/ceramic composition, composite polymer, and surface oxidation technologies



### Valuable wasted metal recycling technologies

- Scraps/slugs, electronics, wet/dry methods, and valuable metal recovery technologies

# AI & Mechanical System Center

The center for intelligent machine systems seeks integrated technologies of design, production, and verification test for product development specialized in CAE engineering, ICT & Intelligent control, smart welding. And we seeks to smart engineering for health monitoring of the fabricated components in the all industry. Its research processes are systematized as a one-step-service type. The center aims at providing a total solution for products developing technologies by efficiently solving multidisciplinary complex problems and research diversity of product commercialization through industry-academy-institute collaboration.



## Multi-Dimensional Manufacturing Technologies

- Design technologies
  - Performance optimization design technologies based on system engineering
  - Reverse engineering technologies using 3D scanings
- Analysis technologies
  - Total solution analysis technologies using M&S method
- Diagnosis technologies
  - Subjective evaluation rating analysis technologies
  - Statistical analysis
  - Rating prediction Index & S/W development



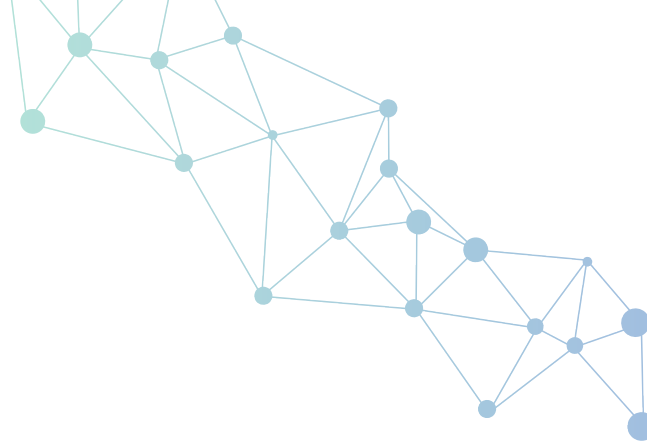
## Manufacturing Process Advancement technologies

- Welding/bonding and assembling technologies for light-weight automotive bodies
- On-site customization of high deposition/productivity welding process technologies
- Metal 3D-printing technologies responding the 4th industrial revolution
- Non-destructive inspection technologies to secure processes and components integrity
- Welding/blanching process technologies for the convergence of smart factories



## ICT Convergence Technology

- IoT Platform Technologies
  - Smart gateway technologies for IoT
  - Dispersive data service based middleware technologies possible to restructure
- Motion Control Technologies
  - Piezo/VCM control technologies
  - Highly precise measurement and error compensation technologies
- Sensor technology
  - Electricity and electronics technologies for large-scaled power transformation
  - Precise measurement technologies based on electrostatic capacitance
- Image Recognition Technology
  - High-speed object detection and classification technologies of 2D/3D images



## Location

175-28, Goan-ro 51beon-gil, Baegam-myeon, Cheoin-gu, Yongin-si, Gyeonggi-do, Republic of Korea

**Tel** +82-31-330-7114 **Fax** +82-31-330-7111

**E-mail** mhs8241@iae.re.kr **Homepage** <http://www.iae.re.kr>

