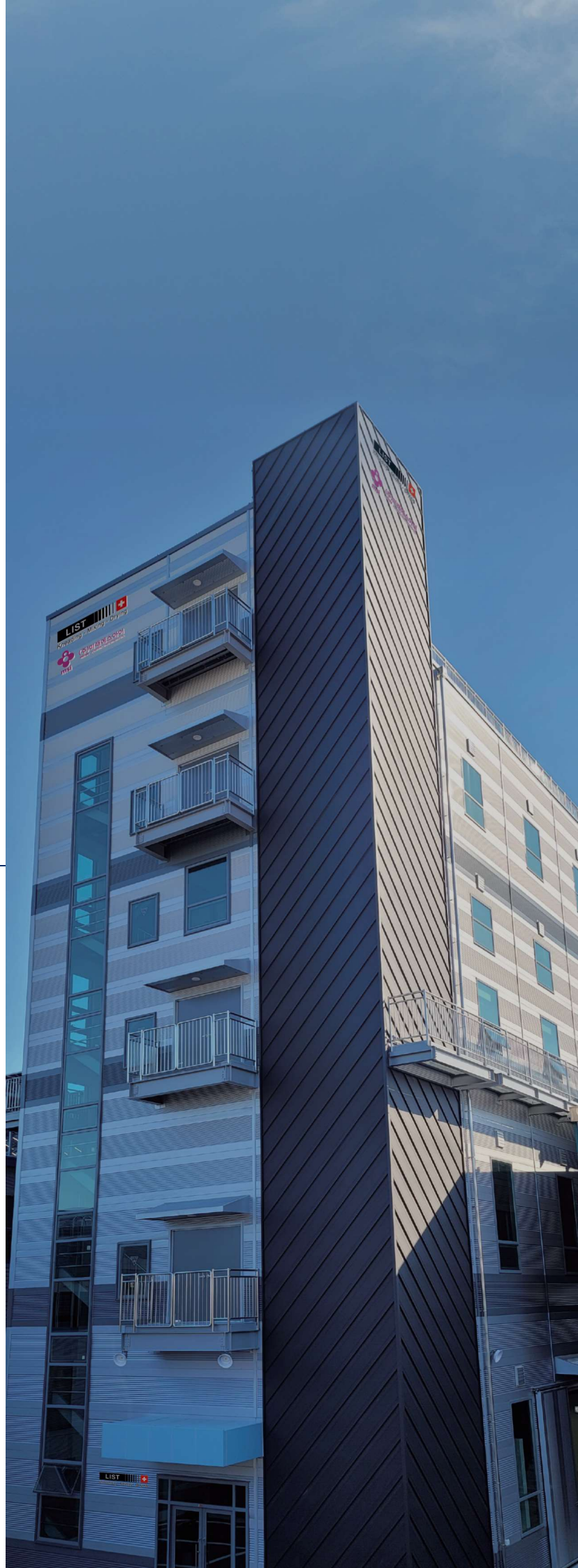


# LIST-MSI ASIA TECHNOLOGY CENTER

English Ver.



(주)미래에스아이  
mirae scientific instruments Inc.



# BUILDING A BETTER FUTURE THROUGH CONVERGENCE OF LEADERS



LIST is a pioneer and world leader  
in the field of high viscosity processing



LIST Technology AG (LIST) is a Swiss unique and high-tech company specialized in providing solutions for high viscosity and kneading processes. For nearly 60 years, LIST has been dedicated in solving specific and complex rheology challenges with Swiss engineered technology, services, and solutions. LIST, based near Basel, Switzerland, has specialized in the development and manufacture of the world's largest customized KneaderReactor for major industrial applications such as chemicals, fibers, food, and polymers with viscous and adhesive properties and LIST is now the world leader in this niche market.

## An Ability to Innovate is Key to Organization's Survival and Growth

Since 2020, the pandemic has brought a rapidly changing business environment, market and client demand, forcing companies to adapt with the new challenges. LIST also felt the need for innovation and decided on proactive investment (or market expansion) and introduction of cutting-edge IT technology to strengthen its industrial competitiveness. Therefore, LIST from Switzerland and MSI from South Korea





MSI provides the best technology and services in all business sectors, including analytics business, scientific instrument development, engineering, and eco-friendly new material development



Located in Gwangju Metropolitan City, South Korea, Mirae Scientific Instruments Inc. (MSI) has been growing since 2005 through continuous research and development with the goal of becoming a company specializing in chemical engineering and eco-friendly organic/inorganic composites. MSI manufactures various precision analysis equipment such as BET (surface area/pore analyzer), TPD (thermal desorption analyzer), TPR (redox analyzer), and hydrogenation catalytic activity meter, as well as customized systems for laboratory and pilot scales. In addition, MSI manufactures surface-modified silica and rubber-silica composites developed independently to reinforce the physical properties of tire rubber materials for improved fuel economy, grip, and abrasion resistance.

established the LIST-MSI Asia Technology Center (LMATC) since 2021, introduced facility data cloud collection and integrated management software solutions, and industrial IoT equipped with a monitoring system and SaaS software, created a basis for an artificial intelligence and machine learning, and partnered to provide a R&D foundation for innovative companies in South Korea and major Asian countries.



# COMPETENCE OF LIST-MSI ASIA TECHNOLOGY CENTER



**High Viscosity Processing**  
With Improved Efficiency, Safety and Environmental Friendliness

LIST is a pioneer and world leader in the processing of very tough and sticky materials. In contrast to conventional mixing or stirring processes, the LIST KneaderReactor technology requires no or only a few solvents. In addition, it also enables the recovery and transformation of volatile, often hazardous substances from a wide range of distillation residues into valuable side-products.



**As a result, LIST Technology processes not only help our clients simplify their process, save energy, material and storage costs. They are also instrumental in reducing environmental pollution**

When a client is interested in a process solution from LIST, a close partnership begins. Because LIST KneaderReactors and the corresponding processes are used in the world's largest chemical plants, where our kneaders are often the key technology, the client's full confidence in the technology and process is a decisive factor. If the process did not work, the damage would be enormous. Therefore, LIST is committed to a perfect understanding of each client's specific challenges, is fully focused on problem solving and has developed a proven, state-of-the-art testing and intensification procedure.



**When Your Agitator Stops,  
Contact LIST-MSI Asia Technology Center (LMATC)**

LMATC was established in South Korea in 2021 and successfully tested with more than 10 companies less than a 1 year and generated added value for the clients. LMATC provides an environment for tailor-made technology evaluation for multinational companies based in Asia. LMATC's team consists of top-notch 'Process Specialists' involve in 3 independent test facilities\* that can be operated simultaneously to meet the needs of multiple clients. Usually, even before our clients have ordered trials, we are starting to analyze the safety measures needed to secure the process trial challenge. In particular, we consider the handling and preparation of raw materials, the behavior of materials during the process and finally the handling of the product, by-products and waste. The planned trial process gets thoroughly investigated in terms of potentially hazardous and harmful situations during the trial run. The basis for the Safety Risk Analysis is the description of the process by our clients with the active help of LIST Technologists. This enables all team members – such as Process Specialists, Safety Engineers and Technology Center Engineers – to understand the risks of the process and take the right actions to prevent incidents. A final comprehensive check of all trial requirements and boundaries is made during a final meeting together with the client on the day of trial.

\*LMATC's each testing facility is operated entirely separately to protect client privacy, confidentiality and intellectual property rights.

Safety First: Next to the specifics of the KneaderReactor itself, a very important aspect in the development of the process is the handling and feeding of materials into the Reactor, as well as the appropriate and safe handling of products and waste.

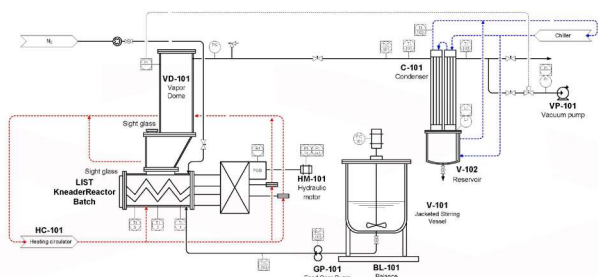


**Essential Process Knowledge and Comprehensive Preparation for  
Successful Testing, R&D and Scale-up**

At LMATC, KneaderReactor technology is available in a range of different capacities, from laboratory and pilot scales to pre-industrial scales.

## Case 1

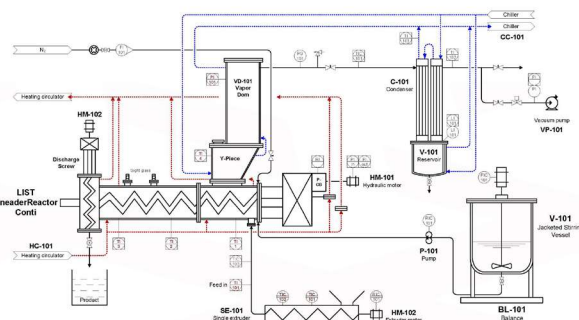
### Batch Feasibility Test



The batch feasibility test has the advantage of being able to collect the largest amount of data in the least amount of time, and the maximum torque obtained here is important data for scale-up. In addition, mixing efficiency, viscosity and color change can be directly checked in real time through the sight glass attached to the side and top of the KneaderReactor,

## Case 2

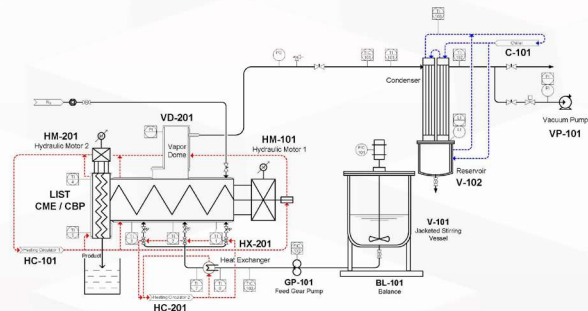
### Continuous Feasibility Test



When a batch feasibility test cannot be performed due to different reasons and a continuous feasibility test is necessary, a customized technology evaluation environment is configured according to the client's needs. Auxiliaries such as feed extruder and a strand pelletizer can be configured for successful continuous feasibility testing.

## Case 3

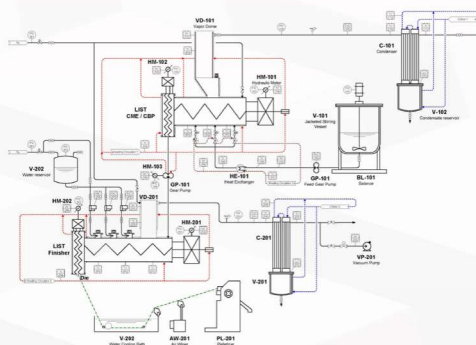
### Continuous Main Evaporation / Bulk Polymerization



At LMATC, the polymer solution with the total solid content of 5~20wt.% can be increased to over 95wt.% through LIST's unique CME (Continuous Main Evaporator) or convert the monomer to polymer with a conversion rate over 90wt.% through LIST's unique CBP (Continuous Bulk Polymerizer). The solvent and volatile substances removed through the vapor dome of the KneaderReactor are condensed and recovered, and the concentrated polymer is quantitatively discharged through the discharge screw.

## Case 4

### LIST Direct Devolatilization Technology (DDT)



At LMATC, LIST's proprietary Direct Devolatilization Technology (DDT) can be demonstrated, whereby the polymer solution with low total solid content initially result in a ppm levels of residual monomers and volatiles at the final discharge.

**Analysis and Reporting :** Every process trial data is recorded with LMATC's data logging system. Together with the trial observations, our LMATC team perform an in-depth analysis to design the optimal process solution. Finally, all results are summarized in an extensive analytic report providing clients a hands-on, fully documented understanding of the challenges and potential of their specific process. In the later phase, this also provides the basis for the industrial scale-up of the industrial KneaderReactor and peripheral equipment.

# SUCCESS OF LMATC BEGINS WITH CUSTOMER SATISFACTION



**Dr. Chanho, Park**

R&D Manager | Hanwha TotalEnergies

The cooperation of LIST-MSI Asia Technology Center was very helpful in verifying the processing technology during our review of technology selection. The environment to assess LIST Kneader Technology was well established and, despite the urgent project schedule, the required tests were successfully completed according to the schedule by acquiring additional equipment by the LIST-MSI Asia Technology Center, completing the required setup necessary for the test. In the case of other companies, they are not flexible or do not cooperate with the installation of an additional requests or changes of the trial conditions. In addition, we think the biggest advantage of LIST-MSI Asia Technology Center is that there is no need to conduct such trials in other continent. If any further tests are required in near future, we plan to actively request cooperation from the LIST-MSI Asia Technology Center.



**Sungwon, Lee / Dr. Do Young, Kim**

Professional Manager | SK Innovation | Institute of Environmental Science & Technology

We needed to evaluate and verify processing technology suitable for polymer compounding, and because the LIST KneaderReactor from Switzerland and the evaluation capabilities and resources were well-established at the LIST-MSI Asia Technology Center, the required validation could be completed successfully. In particular, the accessibility was out of question as the Kneader is installed in South Korea, and evaluation under various conditions were possible. During the evaluation, mixing efficiency, viscosity, and color change were directly observed in real-time through the sight glass, and the reaction conditions were optimized accordingly, which was helpful for process validation. In addition, during the testing, we were able to discuss the evaluation results based on on-site data. Such competence of LIST-MSI Asia Technology Center has many advantages in terms of Kneader-related evaluation and joint research and development compared to other companies that can only be possible in overseas. In the future, if additional evaluation of current project and/or other verifications are required, the LIST KneaderReactor will be considered first.



**Jangwoo, Seo / Specialist**

Project Leader | CJ CheilJedang | White BIO R&D Process Engineering

Our company needed to conduct thermal degradation / pyrolysis pilot test urgently, and we were able to test this because the LIST-MSI Asia Technology Center was well equipped with the KneaderReactor System and the R&D environment. With qualified support and resources, the tests went smoothly, and comprehensive data was obtained, which greatly aided decision-making. In particular, the fact that we could visually see the inside of the KneaderReactor during the process with our own eyes had a big advantage. If testing for another high-viscosity materials is required in the future, the LIST KneaderReactor will be considered again.



**Dr. Ji-Hun, Kim**

Professional Manager | SK Chemicals | R&D, Environmental-Friendly Materials

As well-known in the industry, the LIST KneaderReactor has been recognized as a processing equipment to increase the degree of polymerization of high-viscosity polymers only. This time, we were able to confirm that LIST KneaderReactor is also valuable in the field of low-viscosity material like ours. Without the active cooperation and operation of LMATC to reach the desired result, it would have been a much more difficult process, but thanks to LMATC, we were able to get faster results and go one step further in decision-making. In addition to the ongoing R&D PJT, we will consider LMATC for active utilization, as well as for the upcoming PJT.

| CLIENTS |



| PARTNERS |





Republic of Korea  
Switzerland 60<sup>th</sup>  
anniversary  
1963-2023

**LIST**   
Kneading · Mixing · Drying



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