Fundamental Technologies Supporting Sustainable Growth

R&D

With the evolution of our core technologies and the increasing strength of our fundamental technologies focused on our key concepts of *Clean*, *Safety*, and *Frontier*, we will create unique value and achieve our goal of “Creating a future that supports society”

Executive Officer
General Manager of Engineering Headquarters **Kazukiyo Teshima**

PILLAR Corporation’s Core Technologies and R&D Concepts

Since our founding, we have been utilizing our fluid control technology and material development expertise to explore little-known materials while pursuing research and development targeting the most advanced technologies. This effort is part of our initiative to create value that adapts to market trends while addressing societal issues.

Our fundamental technologies—which include sealing, material engineering, mechanical engineering, injection molding, analysis, and mold design—support the evolution of the core technologies of both our Electronic Equipment Business and our Industrial Equipment Business.

In our Electronic Equipment Business, our core technologies include the manufacture of resin seals, fluororesin injection molding, microscopic analysis, and computer-aided engineering (CAE). These technologies are used mainly in the development of products for the semiconductor market, an industry noted for requiring high levels of cleanliness. In our Industrial Equipment Business, our core expertise includes tribology, material formulation, and CAE, which are mainly used in the development of products for the power and petrochemical markets.

The core technologies that have evolved in each of our business segments are disseminated to our personnel through the normal rotation of roles across our various businesses. We are combining these core technologies to promote value creation even as we accelerate the evolution of these technologies. In addition, by appropriately reviewing our development portfolio, we are examining the balance between R&D and product development, and between the acquisition of new technologies and the strengthening of existing technologies. At the same time, we are promoting technological development for the short term as well as the medium and long terms.

Analysis and Testing Equipment

As the owner of many patented products, we conduct a number of experiments under actual operating conditions before introducing our products to society. Our research and development, supported by the latest verification technologies, continues to evolve toward even higher goals.

Microscopic analysis technology

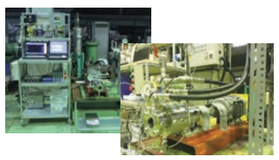
In order to meet the ever more stringent cleanliness requirements associated with the increasing miniaturization of semiconductors, we are building a system capable of performing multifaceted analysis of both organic and inorganic substances.

Design with 3D CAD

We undertake basic structural analysis and design in a seamless manner, which leads to faster product designs and targeted solutions.

Test equipment for semiconductor and liquid crystal manufacturing devices

To evaluate performance under the harsh operating conditions that exist in the semiconductor fabrication industry, we utilize thermal cycle test equipment capable of cycling between high and low temperatures.



Data collection and analysis test equipment for failure prediction

This test equipment is used to collect and analyze data on pressure, temperature, torque, vibration, etc. under operating conditions, including failure modes, in order to establish technology for predicting mechanical seal failures.

X-ray Photoelectron Spectroscope (XPS)

This analytical device can determine the bonding state of atoms and molecules on and below the surface of a material. This innovation helps to elucidate the tribological phenomena of sealing products for the hydrogen market.

1000 kN universal testing equipment

The device is capable of performing sealing, compression, and tensile tests while precisely controlling the load on products and materials. With 24-hour continuous operation possible, continuous data can be obtained on changes that occur over time.

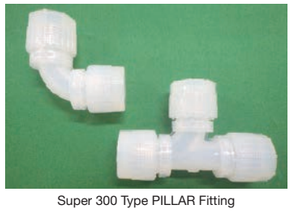
Innovation through Collaboration among Industry, Government, and Academia

EDP® Packing

As part of our effort to improve sealing technology through collaboration among industry, government, and academia, we are conducting research into the optimal sliding interface and optimal lubrication of gland packings. In today’s market, gland packings used for valves are expected to be more environment-friendly than ever before. We select materials that provide sealing performance fully compliant with international standards as well as levels of friction low enough to avoid impeding valve function. In our work, we also consider their environmental impact; toward that end, we use Materials Informatics (MI), which applies information science technology to improve the efficiency of material development. Through our comprehensive research on optimal lubrication and various analyses related to the ideal sealing surface, we are developing products that meet emerging market needs.

Efforts Aimed at the Semiconductor Market

Accompanying the miniaturization of semiconductors, particle reduction demands are increasing year by year, and there is a need to improve the cleanliness of individual components. In terms of materials, we employ our in-house microanalysis technology to develop products offering even higher levels of cleanliness. As for product designs for piping and pump-wetted parts, we engage in “front-loaded” development that uses the data we possess in combination with CAE to identify and solve problems at the initial stage of development.



Super 300 Type PILLAR Fitting

As a sustainability initiative, we are employing the “3Rs” (reduce, reuse, recycle) for fluororesin and are considering ways to utilize this approach in compliance with the specifications required for semiconductors.

Initiatives Targeting Our Solutions Business

Our objective is to provide the market with value through innovation, not only by improving the functionality and versatility of our products, but also by leveraging the expertise in fluid control technology we have refined over the years. Toward that end, we are focused on establishing a mechanical seal condition monitoring service. Building on our many years of experience in design and development, we have produced a sensor that provides a visual representation of the operating status of a mechanical seal. This breakthrough reduces the risk of production loss due to issues arising with our customers’ production equipment.

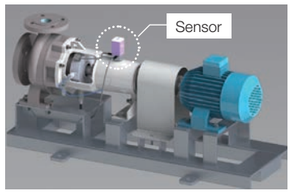


Illustration of a pump-mounted sensor

Moreover, we provide a service that incorporates condition-based maintenance (CBM) as a means of optimizing equipment maintenance. We remain focused on accumulating actual equipment condition monitoring data as we work to establish technologies capable of failure prediction.

TOPIC

Applying Digital Transformation to Material Development: Front-Loading of Powder Compression Molding

Many of our main materials are available in powder form. Unlike liquids, powders generally undergo plastic deformation in which the volume changes. We therefore need to develop “front-loaded” materials requiring no rework. Toward this end, it is essential that we have access to analysis technology that accurately predicts phenomena such as complex constitutive equations and the identification of cracks and chips. To address this need, we developed an AI algorithm that accurately identifies the parameters of the constitutive equation and the corresponding test device. This approach provides us the ability to predict phenomena with an error rate of less than 5%, thus minimizing density unevenness in molded bodies and reducing the amount of material used.

Digital transformation is enabling us to perform comprehensive desktop research on the powder molding process, which is resulting in the development of materials that require no rework.