

Research & Development

To continue providing value in the years ahead, the AGC Group is utilizing its plentiful technology base in glass and fluorine chemistry as we focus on cultivating new businesses that will serve as future pillars of growth. We are currently sharing our future-oriented "Technology Roadmap" throughout the entire AGC Group while undertaking Group-wide strategic R&D activities.

Expanding Our Business Domains by Advancing Our Core Technologies

As an expert in materials, the AGC Group has created an abundance of technology platforms spanning organic and inorganic materials based on core technologies, centered primarily on glass and fluorine chemistry. These core technologies include "glass materials and production technologies", "fluorine and chemistry technologies", "optics and electronics technologies", and "coating technologies", in addition to "fundamental common technologies (simulation, analysis, others)" and "equipment technologies". Throughout our history, the AGC Group has utilized numerous competitive advantages in these fields to continuously distinguish itself from competitors while expanding its businesses.

From our inception in 1907 with flat glass for construction as our core business, we have advanced our composition design, manufacturing, and processing technologies. This has allowed us to expand glass applications to automobiles, flat panel displays (FPD), and electronics.

Our fluorochemical business traces its origins to the use of chlorine, a byproduct in the production process for caustic soda. Utilizing the various applications of chlorine, the Group has since gone on to manufacture chlorinated compounds with unique properties and developed a diversity of value-added products, including fluorinated water and oil repellent agents and fluoropolymer films.

In electronics fields, which are regarded as a highly promising business domain of the future, the AGC Group has developed synthetic quartz lens materials for steppers and optical planar devices for digital video discs (DVDs). In environment and clean-energy related fields, we are expanding businesses and promoting technological innovations for transparent conductive oxide (TCO) film substrates for thin film silicon solar cells. We are also focusing on the development of technologies for membrane-electrode assemblies (MEAs) for fuel cells and are carrying out research on in-flight melting, a revolutionary new glass melting technology that enables a dramatic increase in energy efficiency during production.

Offering High Value to Customers Based on the Group Vision

In accordance with the AGC Group Vision "*Look Beyond*", our R&D mission is to offer technologies and products that provide customers with value in our three mainstay domains of glazing, display, and electronics and energy (E&E). With the Research Center functioning as the nucleus, the R&D Division takes a long-term perspective spanning more than 10 years in carrying out seamless

R&D that ranges from basic research to product development related to necessary functions and materials for the future. In glazing, our research focuses on contributing to comfort and the environment through glazing materials, which serve as "entryways" and "exits" that draw out the potentials of glass and control light, heat, sound, and electrical waves. Regarding display materials, we are responding to market needs for large sizes, high-definition, and thinner materials by enhancing our glass substrate materials composition and production technologies. In the E&E field, as we gear up for a new phase of growth, the AGC Group will proactively allocate R&D resources toward this field while striving to create essential components for supporting next-generation industry.

Pursuing Synergies within the Group through Our Technology Roadmap

We are formulating a Technology Roadmap that is to be shared throughout the entire AGC Group. This technology roadmap is based on our Technology Outlook, which looks beyond 10 years into the future and integrates a broad range of information, including macrotrends related to population, energy, and the environment, as well as data on industry trends. The Technology Outlook considers the impact of these trends on current business, makes proposals related to future business opportunities and domains for concentration of resources, and clarifies essential technology development themes for the future.

Guided by the Technology Outlook, the Technology Roadmap emphasizes various activities from the perspectives of the technologies and resources required in the future, taking into consideration our current technologies. By sharing the Technology Roadmap globally throughout the AGC Group, we will maximize Group-wide synergies that will lead to ongoing growth of our existing businesses and to the creation of new businesses.

An R&D Structure that Facilitates Organic Collaboration

The AGC Group has organized an R&D structure that facilitates organic collaboration among its business divisions and corporate divisions. The Research Center handles basic, long-term, innovative, and inter-business themes. Development Centers affiliated with business departments of each In-House Company or Strategic Business Unit (SBU) enhance production technologies and undertake product development in close contact with manufacturing departments and customers. Meanwhile, the Engineering Center undertakes the development of innovative production technologies and equipment

technologies. Collaboration among these research facilities enables speedy R&D and helps us effectively implement our Technology Roadmap. Researchers at the Research Center belong to functional groups for individual technologies. At the same time, cross-functional teams are formed for research themes requiring a comprehensive perspective. By taking this approach, we strive to promote a fusion of technologies and accelerate development.

In assessing such areas of our operations as environmental impacts, marketability, competitive superiority, suitability, and widespread dissemination, we introduced Stage-Gate as a method for evaluating the establishment

of research themes as well as the state of progress and feasibility of continuing our research themes. By introducing this assessment tool, we can properly allocate and reallocate our resources depending on the stage of progress of each research theme. Additionally, the AGC Group is incorporating various other flexible frameworks in aiming to provide new functions based on contemporary market needs. Efforts include utilizing an industry-university joint research structure through open recruitment from universities and external research institutions along with marketing conducted by researchers.

Close up

Toward the Development of Glass Melting Technologies that Reduce the Environmental Burden

In-flight melting technology reduces energy consumption by more than half during the glass melting process.

The AGC Group has progressed with the development of an innovative glass melting technology that utilizes in-flight melting. The development of this technology has paved the way for reducing energy consumption during the glass melting process by more than half.

In the glass melting process, several kinds of raw materials are melted in the furnace at a temperature of approximately 1,600°C. Under the currently used melting method, combustion burners apply heat from above the pile of batch raw materials that are fed into the melting furnace. However, this method has drawbacks that include poor energy transfer efficiency and poor glass homogeneity just after melting, which makes it necessary to "simmer" molten glass in a melting furnace for a long period to improve homogeneity, a process that consumes large amounts of energy. Finding solutions to this problem of poor energy efficiency has thus been a main task in glass production.

As one such solution, a new in-flight melting technology is proposed, in which granulated raw material mixtures are prepared prior to being fed into the furnace. These granules are then injected into a furnace and melted using an oxygen burner at a flame temperature of approximately 2,000°C and a plasma burner at a flame temperature of approximately 10,000°C. The basic concept of in-flight melting entails passing injected granulated raw materials through a high-temperature flame for melting into glass in less than 0.1 second and obtaining highly homogenized glass melt. This manufacturing process can utilize extremely small-sized manufacturing facilities, which enables a sharp reduction in the time needed for glass melting and achieving homogeneous glass. Therefore, energy consumption can be reduced to less than half that of conventional melting methods.

The development of this innovative in-flight melting technology has proceeded under a three-year plan initiated in fiscal 2005 by New Energy and Industrial Development Organization (NEDO) as part of a leading-edge national project for basic technologies. Having participated in research from the initial phase, the AGC Group has carried out joint R&D with a university and other organizations.

Acting as a main player in this project, the AGC Group is undertaking such activities as establishing pilot plants inside its own plants

and developing in-flight melting as a core technology. At present, this research is making significant progress and we are moving closer to achieving the aims of the basic research project, which include realizing targets for energy reduction and solving technological problems. In the future, a principal task will be developing practical-use technologies for mass production, including technologies with applications in the manufacture of special glass such as display glass.

One of the AGC Group's technology strategies under its medium-term management plan that runs through 2010 is to carry out "proactive environmental activities." In the future, we will continue to undertake R&D directed toward realizing practical applications for a mass production process for in-flight melting technologies.

