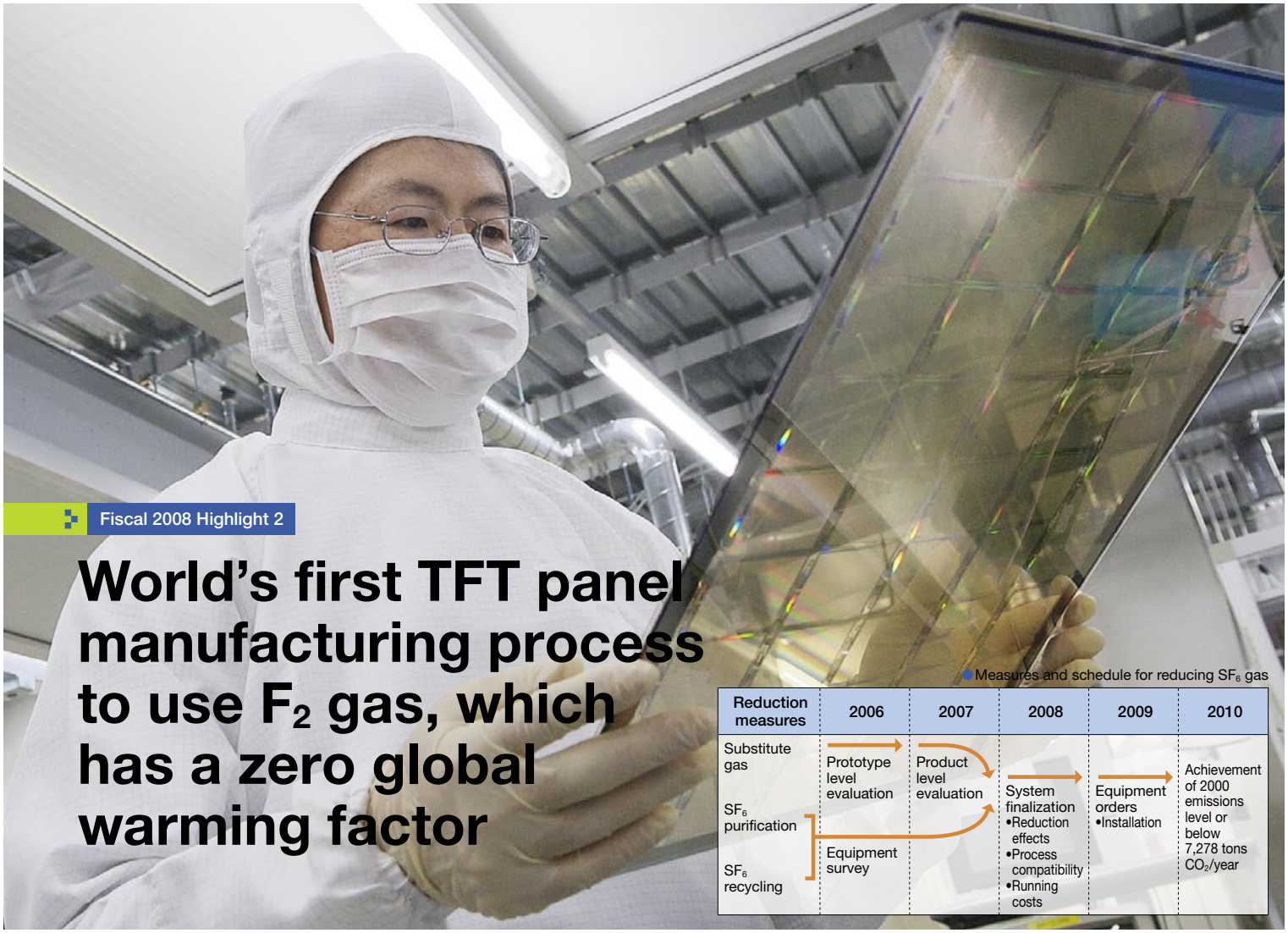


Fiscal 2008 Highlight 2

World's first TFT panel manufacturing process to use F_2 gas, which has a zero global warming factor

● Measures and schedule for reducing SF_6 gas

Reduction measures	2006	2007	2008	2009	2010
Substitute gas	Prototype level evaluation	Product level evaluation	System finalization •Reduction effects •Process compatibility •Running costs	Equipment orders •Installation	Achievement of 2000 emissions level or below 7,278 tons CO_2/year
SF_6 purification / SF_6 recycling	Equipment survey				

In order to contribute to easing global warming, Casio has set the target of reducing its emissions of greenhouse gases other than CO_2 to the same level as fiscal 2000 or below, by fiscal 2010. Since 2004, Casio has been working on a new manufacturing process that will contribute dramatic reductions to help meet this goal, and has now succeeded in introducing it.

In 2008, Casio's Hachioji R&D Center finished development of a dry etching process for TFT panel manufacturing using F_2 gas as a substitute gas for the greenhouse gas SF_6. Casio thus became the first company in the world to succeed with this process. F_2 gas has a global warming factor of zero, making it a very promising gas for combating global warming.

The Hachioji R&D Center is currently preparing for the verification test phase to be undertaken at Kochi Casio Co., Ltd., the company's production site for TFT panels.

A dramatic breakthrough in the TFT panel manufacturing process

There are six gases designated as greenhouse gases subject to control by the Kyoto Protocol, CO_2 being the most notorious. The degree of impact of each gas on the environment is different, even with the same quantity of emissions. One of these gases, SF_6, has a global warming factor of 23,900. In other words, it generates 23,900 times more warming than the same amount of CO_2, making it a greenhouse gas with a very significant impact.

SF_6 has been the conventional gas of choice for the dry etching process of TFT panel manufacturing, for producing ultrafine patterns in the silicon material of thin film transistors. SF_6 is pumped into a vacuum, and high frequency electric energy is discharged to generate plasma. The basic dry etching process involves precisely forming a silicon membrane on a glass substrate using this plasma.

Only minute quantities of SF_6 gas are needed for dry etching, and Casio purchases less than 2 tons of the gas each year. However, since it has such a high warming factor, SF_6 gas accounts for about 20% of the global warming gases emitted by Casio's Electronic Components business operations. Reducing emissions of SF_6 gas is a major issue for the TFT panel industry as a whole, not just for Casio.

As an option for reducing SF_6 gas emissions, equipping production facilities with scrubbing devices is presently the standard method in the industry. Hisao Tosaka of the Electronic Device Division, who is leading the verification testing of the manufacturing process, gave the reason Casio focused on F_2 instead of following the majority: "Simply because F_2 gas has a zero global warming factor."

"If we can achieve a manufacturing process using F_2 gas, no matter how much we increase TFT panel production in the future, the theoretical value for the warming factor of this process will still be zero. Zero

Hisao Tosaka
Electronic Device Division

The engineer responsible for developing the process using F_2 as a substitute for SF_6 gas in the dry etching process employed in the manufacture of TFT LC panels. The recent successful trial manufacturing run was the first in the world.

Yasushi Nakajima
Electronic Device Division

The management representative for the process development using the substitute gas. As Mr. Tosaka's manager, oversees the progress of the research and tests from a technical perspective, and provide support.

Hisatoshi Mori
Electronic Device Division

To ensure smooth cooperation with the production department, worked with Mr. Nakajima to create the policy for implementation of the new process using F_2 gas.

is still zero, whatever you multiply it by. Whether from the point of view of the true spirit of Casio, or from my viewpoint as an engineer, working to solve a problem that nobody had attempted before felt extraordinarily worthwhile." (Tosaka)

Consideration for the environment while maintaining product quality

F_2 gas is hardly used at all by digital component manufacturers. When Casio began experiments with it, a particular concern was the prevailing notion that F_2 gas is highly reactive and difficult to handle. In addition, since F_2 gas is used with other gases for dry etching, it was necessary to start from zero in gathering data to verify its safety when F_2 is mixed with these other gases.

"Through a lot of careful experimentation, we found that if you pay attention to the levels of silane, ammonia, and chlorine that have always been used in manufacturing TFT panels, you can manage F_2 gas perfectly well." (Tosaka)

Looking back at his research with Tosaka, Yasushi Nakajima of the Electronic Device Division says, "It wasn't just a matter of using F_2 gas. It was hard to get the same sort of performance with F_2 gas that we could get with the conventionally used SF_6. The manufacturing process is not really something that the customer gets to see. Nevertheless, it is Casio's mission not only to give the world excellent products, but also to manufacture them using environmentally innovative production methods. That's part of what it means to contribute to society through products."

In 2008, after several years of research, the original R&D targets for a manufacturing process using F_2 gas were achieved—both the safety aspects envisioned for actual operations in the plant, and the performance aspects linked directly to productivity and the quality of the TFT panels. Looking to the future, Hisatoshi Mori of the Electronic Device Division says, "What form will the technology take that we provide to the plant for achieving the targets for 2010? We'll hold consultations with the relevant departments, and work to determine the plan for the system architecture over the course of this year."

Annual emissions of SF_6 from Japan's electronic component and device manufacturing industry*

Equivalent to

1,176,090 tons-CO_2

If F_2 gas is used as a substitute for manufacturing TFT LC panels, it will have a significant impact in reducing emissions of the global warming gas SF_6.

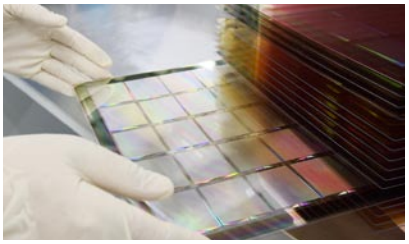
*Source: "Aggregate Results of Greenhouse Gas Emissions in Fiscal 2006 in Accordance with the Greenhouse Gas Emissions Calculation, Reporting and Publication System Based on the Law Concerning the Promotion of Measures to Cope with Global Warming," Ministry of the Environment, Japan, March 28, 2008.

Aiming to use Casio's original technology to make a global-scale environmental contribution

Casio's successful test using F_2 gas in the manufacturing process for TFT panels is the first such case in the world. Casio has demonstrated the potential of using a substitute gas for the dry etching process. The benefits of environmental technology development do not stop at just one company.

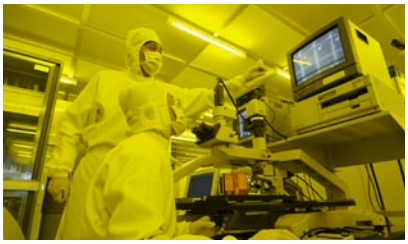
"The amount of SF_6 gas used by all TFT manufacturers in Japan is more than ten times that of Casio alone, and the total for manufacturers worldwide is ten times that again. The development of an alternative technology for SF_6 presents the possibility, not only for Casio, but also for the whole industry, to reduce its impact on global warming significantly." (Tosaka)

This environmental technology, which no other company had attempted before, came about because Casio took on the challenge of using a gas with a zero warming factor. Casio's concern for the sustainability of the global environment has taken yet another new form, driven by the company's enthusiasm for technology. Casio is determined to keep making the world a better place.



TFT LC panels being processed. In the etching process, the surface is homogenized, and the iridescent part of the surface disappears

Dry etching facilities. The equipment visible at left controls the F_2 gas, while the equipment in the center supplies the gas



Using a microscope to inspect the surface quality of the TFT LC panels after the dry etching process with F_2 gas