



## Leading-Edge Technologies Delivered from Kumamoto Prefecture

# Sony's First 300 mm Wafer Fab Line Is Now Operating

### <Kumamoto Technology Center>

Location: Kumamoto Tec Techno-Park No. 2  
4000-1 Haramizu, Kikuyo-machi,  
Kikuchi-gun, Kumamoto Prefecture

Production system: Wafer process and assembly integrated production line

Products: CCDs, high-temperature polycrystalline silicon TFT LCDs

Site area: 150,000 m<sup>2</sup>  
Clean room area: 20,000 m<sup>2</sup>  
(Clean rooms make up 2 floors of a 7-floor facility.)



Dr. Koichiro Arita  
Corporate Senior Vice President  
Representative Kumamoto  
Technology Center  
Sony Semiconductor Kyushu  
Corporation

*It has been 6 months since the Kumamoto Technology Center, which had been under construction as a business center to handle CCD and LCD leading-edge imaging devices for Sony Semiconductor Kyushu Corporation, started operation in October 2001. Sony's high-temperature polycrystalline silicon TFT LCD panels, which achieve an industry-leading 66.1% aperture ratio, are also manufactured here.*

*This site is Sony's fourth strategic location in Kyushu, following Kokubu, Oita, and Nagasaki, and Sony has adopted the latest technologies and systems so that it will live up to the term "leading edge". These include the new "single wafer spin cleaning" technique, the FOUP local clean technology that replaces SMIF, and 100% support for zero emissions operation. At the same time as improving productivity, reducing costs, and achieving the highest efficiency, these technologies also achieve environmentally friendly operation. Thus Sony has created a truly world-class level 300 mm wafer full-scale fab facility. Sony will be delivering leading-edge technologies to its customers worldwide from this site in Kumamoto. Sony is aiming for production of 12,000 wafers per month by the year 2005.*

## Why Kumamoto?

While Sony already has three technology centers in Kyushu, at Kokubu, Oita, and Nagasaki, I suppose the question on everyone's mind is: why Kumamoto. Kumamoto is centrally located in Kyushu, as it's nickname, "Kyushu's navel" indicates. Fresh water from the aquifer under Mt. Aso is plentiful, and the site is 15 minutes from Kumamoto Airport, which can be used for transport. Thus the first point is that Kumamoto is advantageous geographically. The second, and deciding, point, was that many semiconductor-related companies have already set up facilities in the Kumamoto area, allowing Sony to make use of local companies with superlative technologies and a pool of talented specialists. While there were other candidate sites for this facility, as the name of the site, "Kumamoto Techno-Park No. 2", indicates, the prefecture strongly promoted Sony's selection of the site, leading to the creation of this facility in Kumamoto.

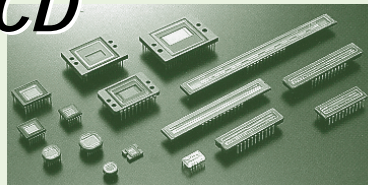
While we do hope to be able to hire much of our staff locally, we also hope to contribute strongly to training and education of talented people from the region. One aspect of this has been our cooperation in the Department of Visual System Engineering (which was established in April 2002) at the Kumamoto Prefectural College of Technology located adjacent to the Sony facility in the same technology park. We plan to provide four instructors from our staff to instruct students. Furthermore, I am employed as a visiting professor at the Kumamoto University Co-operative Research Center. To respond flexibly to changes in the business environment, Sony is committed to developing the EMCS concept, which aims at a design and production system architectures for the new age. I think that these represent a further step towards educating a pool of talent. By the way, this facility currently has 450 employees, and the average age is 29.7. Since the average at the Kokubu Technology Center is 35, you can see that this is a youthful factory.

## Leading-edge products from a leading-edge factory

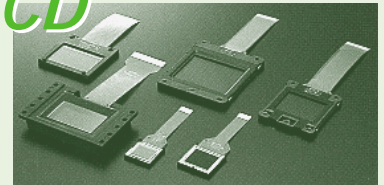
An extensive collection of technologies. Responding to the difficult challenges of achieving higher pixel counts and higher sensitivity. The difference can be seen in the beauty of the images produced.

By achieving extremely higher precision and higher optical transmittance in SXGA panels and other products, high-temperature polycrystalline silicon TFT LCDs are creating the potential for new applications.

# CCD



# LCD



## Plant Technologies that Aim for the Next Generation

If you take a tour of the factory, one point will be immediately obvious: both the wafer clean room on the third floor and the assembly clean room on the sixth floor are enormous spaces broken only by a row of columns down the center. Each floor consists of two 33 × 154 meter spaces. Of course, these rooms have a ceiling height that provides enough space for 300 mm wafer equipment and mini-environment equipment. The facility meets low-level vibration specifications that allow it to support 0.1 μm scanners and steppers, and thus has a structure that can support not only the current generation, but the next generation as well.

Previously, it would have been difficult to assemble facilities such as these in a single location. Improvements in advanced construction technologies made it possible to establish this factory. Under this environment, we can operate multiple mini-lines, each with a length about one sixth of that used in conventional facilities. This allows us to flexibly control production capacity according to our customers' needs.

## Aiming to Achieve 100% Zero Emission for the First Time in the Industry

Kumamoto Technology Center was constructed from the start with the goal of achieving zero emissions, and it was already achieving a recycling ratio of 99.2% at the point it started operation. I've heard that the industry's top level is 98%, but we intend to progress further and reach a 100% recycling ratio in the near future. In particular, we divide the large volumes of water emitted by the semiconductor factory into as many as 26 systems, enabling thorough recycling. We are making positive efforts at saving energy and reducing resource usage, for example, by adopting an ice thermal storage system to take advantage of off-peak power rates and by using solar power. We have adopted a consistent policy of optimization, from manufacturing equipment through the whole factory. At the same time, to assure stable infrastructure operation, we have also implemented a top level risk management system that handles power blackout and instantaneous brownout, water shutoff, and unavailability of fuel.

## "Silicon Forrest" Concept for a City in the Woods

There is a strong trend in the semiconductor industry towards shifting production to China. I think that is appropriate for manufacturing areas where production is already established, and I also think that this trend will continue. Still, our Kumamoto facility is a factory that speaks to the issue of how fast production of new products can be brought on line. Therefore this unified production system, which can reflect comments received directly from out customers and allows test products to be verified during the development process, is a valuable system to have in place.

We are proposing a "Silicon Forrest" concept for Kumamoto, which is nicknamed "City in the Woods". Since we have acquired enough space to build another factory of the same scale as this building (factory) directly adjacent to it, we would very much like to see the second building constructed and both operating at full capacity. This may be the last site in Japan where a factory of this scale can be built.

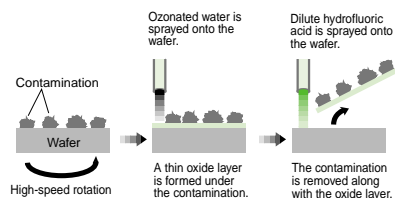
### Single-wafer spin cleaning technology is effective for low-volume production

The single-wafer spin cleaning technique, is, compared to conventional cleaning methods, a powerful technique that achieves shorter times and lower costs. It was first adopted at Sony's Nagasaki site and is now adopted here for the second time.

Multi-tank cleaning methods, which require large amounts of DI water, are problematic from an environmental protection standpoint. In contrast, this new method only uses dilute hydrofluoric acid and ozonated water. Ozonated water breaks down into water and oxygen, and has no environmental impact. Furthermore, since this technique cleans one side of a wafer at a time, it makes it possible to use methods in which only one side is cleaned. This new technique requires a mere one sixtieth of the time and one twenty-fifth of the DI water.

Although we only started full-scale operation recently, it is already providing results that are equivalent to or better than earlier methods. Furthermore, it has the advantage that since wafers are handled one at a time (as the name single-wafer spin cleaning implies), damage is held to an absolute minimum should some problem occur and it is therefore suitable for low-volume production of high-functionality products.

#### Single-wafer spin cleaning technology overview



### FOUP and the automatic transport system able to handle 300 mm wafers

In place of the SMIF (Standard of Mechanical Interface) local clean technology adopted at the Nagasaki Fab1 site, the Kumamoto facility has adopted the FOUP (Front Opening Unified Pod) system to implement mini-environments.

While the SMIF system uses vertical motion to insert and remove cassettes from the pod, the FOUP system uses front-to-back motion. Another difference is that the pod and carrier were separate units in the SMIF system, but are a unified unit in the FOUP system. This makes cleaning the pods easier.

One new idea in the FOUP system, which was adopted due to the increased weight of the 300 mm diameter pods, is the use of an automatic transport system suspended from the ceiling for transport of wafers between units.

