



1981-2006

At Isofotón, R+D is a strategic axis of growth. With its constant increase in potential, it contributes to generating knowledge, in a way which places this technology at the service of society.



6.4 INNOVATIONS IN PRODUCTIVE PROCESSES

Important technical innovations have been introduced this year throughout the company's productive process. They are the following:

Cut

As a consequence of the shortage of materials and a resulting regimen of low exploitation, 2006 was characterized by great activity on the level of improvement. The most significant was the **progressive reduction in thickness in cutting**, going from 330 microns to the current 240 microns. The keys were the improvements in the refrigeration systems of the equipment, the introduction of rollers with appropriate automation, as well as the use of new string trimmers of up to 240 Km in length and 160 microns in diameter.

Another great innovation on the level of cutting processes was the start-up of the **automated rod cleaning system**, and the later optimization of the process. This allowed for the elimination of the use of solvents like n-decano and the significant improvement of productivity in the area.

Over the year new adhesives were also introduced for attaching the rod to the glass. This allowed for the elimination of the use of acetic acid in the cleaning of the wafers and for the improvement of cycle times.

Cells

The arrival of the first process line for **156 micron cells** (a great novelty of 2006), in addition to providing the zone with an annual capacity of 25 MWp in 6 inch cells, brought numerous improvements to the process:

- 1.- Installation of the Plasma Enhanced Chemical Vapour Deposition (PECVD) system to apply silicon nitride to the antireflection (AR) coating, substituting the traditional titanium oxide. The system brings a new generation of automation of high precision charge and discharge. The low periods of the cycle permit, at this point, the realization of quality control of both diffusion (through the measurement: the resistance of the coating) and of the nitride coating placement (through artificial vision systems) of 100% of production.
- 2.- Introduction of a new step in the process between diffusion and the AR film to eliminate the phosphorous glass coating, consisting of a fluorhydric acid chemical attack. It allows for the use of the effects of frontal passivation in the nitride silicon process and for the achievement of an increase of up to 0.5% in efficiency of the cells produced.
- 3.- Introduction of the drying system through ozone after becoming textured. It allows for working with thinner wafers that would not handle the previous drying process of centrifugation in a nitrogen atmosphere.
- 4.- Use of the laser edge isolation system. The principal advantages of the techniques that use plasma are the sturdiness of the process, the on line integration, and the disappearance of esthetic defects (type C) caused by plasma penetrations on the cells' surfaces.
- 5.- Implementation of the new electric and esthetic classifier which has allowed for

the elimination of manual esthetic classification of 156 micron cells.

Modules

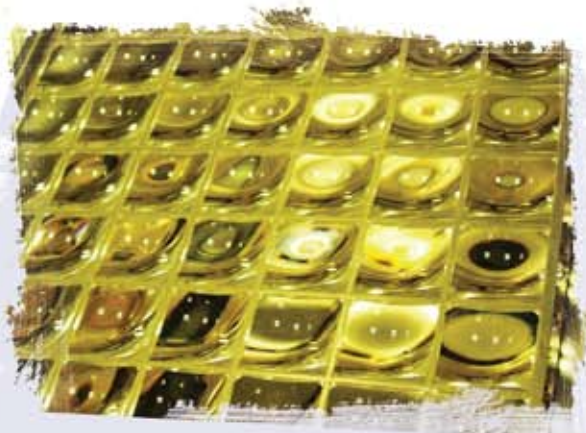
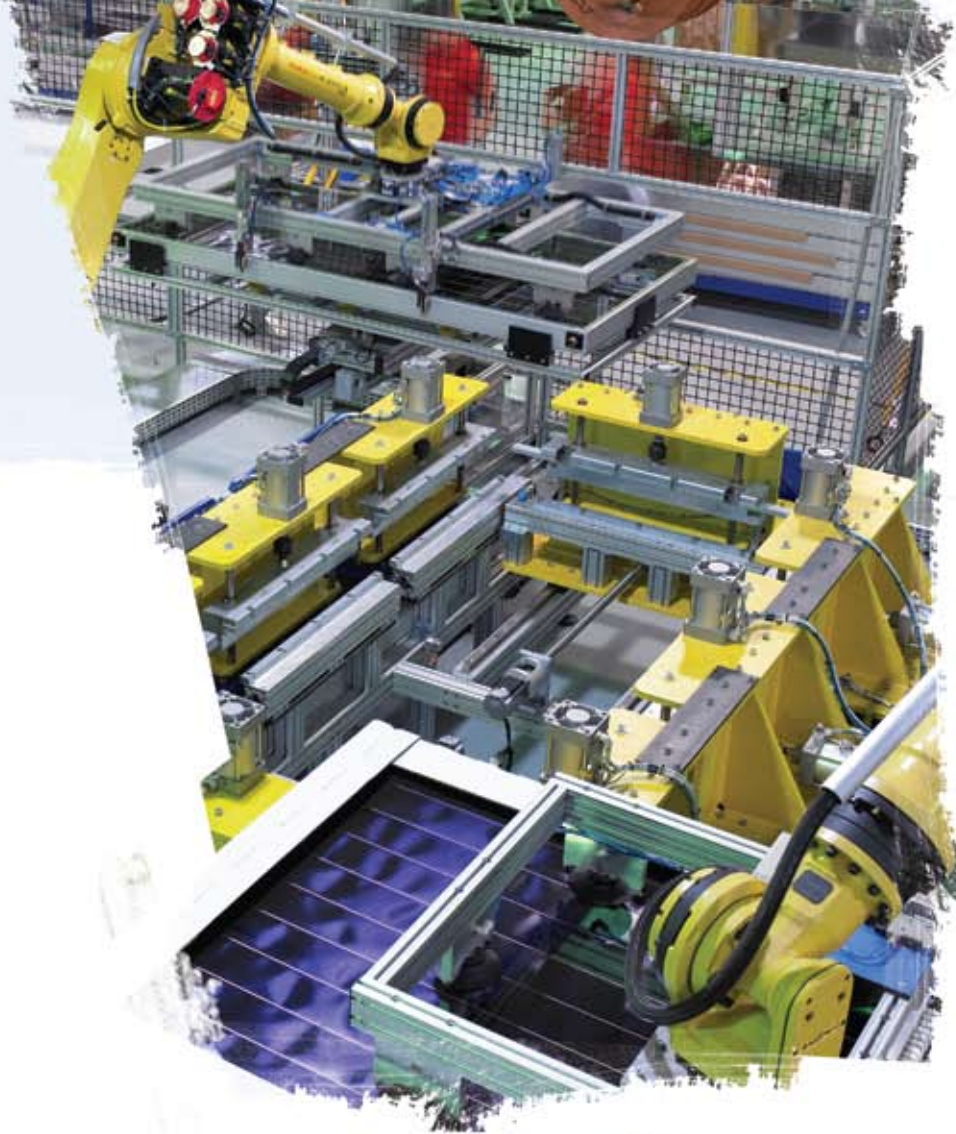
The module area has had to suffer an accelerated evolution in processes and work methods to adapt to the **new standard thicknesses of less than 240 microns**.

In compliance with the ROHS legislation, all of the welding machines were adapted to the process with flux, at the same time as the implementation in production of 8 high capacity 2nd generation machines, and finally, the first 3rd generation machine, going, therefore, from the traditional hot plate and paste two-step welding systems, to the current welding systems of only one step through infrared lamps and flux.

An arduous innovation job in the area of materials allowed for the identification of most adequate linking strips for ultra-thin cells, which bring a perfect balance of adhesion and conductivity with the lowest process temperature.

On the product side, the IS-207/210 and the IS-155/160 ranges were introduced, all based on high efficiency 5 inch cells.

The introduction in May, and the following generalization of microtexture glass meant an increase of 1.5% in the nominal power of all modules.



Thermal

- 1.- Start up of the new Thermal section, incorporating principal activities such as the automatic oxyacetylene welding (brazing) for the formation of the grill, the use of **ultrasound welding** to join the selective band and grill, and finally, robotized cells for collector assembly of collectors.
- 2.- End of production of Garol and Isonox II models in Spain.
After the start up of the new plant for the production of Isotherm Plus collectors, the production of Garol and Isonox II collectors was suspended. The machinery and know how will be transferred to the Dominican Republic, where Isofoton will take up the production of these models again in 2007 to help the Central American and South American markets.

Concentration

2006 focused on finalizing the most outstanding highlights of this technology, and on the adequacy of the productive processes to being commercialization in 2007.

The following new points stand out:

- 1.- Installation of a **10000 class Clean Room** (controlled atmosphere) to undertake, among other activities, the cutting process of solar concentration cells. This automated process allows for the handling of 4" and 2" Germanium and GaAs (Galium Arsenide) wafers on which 3,000 and 1,000 solar cells are placed, respectively. Also, in the said room the installation of another system, developed over 2005 and 2006 by Isofoton and INDRA is planned. This system allows for the classification of the solar cells depending on their electric characteristics. This system is completely new and has

allowed the company an advantage over its competitors and solar cell providers, promoting a tool that, at the same time, allows for the measurement of the quality of solar cells.

2.- Second packaging line.

After the achievement in the development of solar cell and concentration lens encapsulation processes (called packaging), the investment to increase productive capacities was undertaken. With this second line, and in a 7 day/24 hour production scheme, Isofoton can reach 5 MW/year in the process.

3.- Concentration tracker.

As a result of other research activity of Isofoton, which had CDTI funding, a **dual-axis solar tracking system** was developed. This system, with a precision of aim $< 0.1^\circ$ and a 30 m² open area, allows for the placement of a total of 96 photovoltaic concentration modules and reaches a power of 5 kW. This system is installed on the exteriors of Isofoton's factory with appropriate instrumentation to monitor the performance of its panels, as well as radiation and other meteorological data such as the wind velocity, the environment temperature, etc., all absolutely necessary to carry out systematic studies on the evolution of concentration modules on exteriors.



INNOVATIONS 6.5 IN PRODUCTS AND APPLICATIONS

According to the UNPD (United Nations Development Program) Report about Human Development 2006, "supplying clean water, eliminating sewage water and providing drainage services are three of the bases for human development"; however, **1.1 billion people lack access to water and 2.6 billion do not have access to drainage services.**

According to the basic studies carried out for the development of this Report, the higher the poverty level is, the more costly clean water is: 20% of the poorest homes in El Salvador, Jamaica, and Nicaragua spend, on average, more than 10% of their income on water. In the United Kingdom, an expense of 3% of the family income on water is considered to be the threshold of difficult living conditions.

The authors of the Report register annually a rate of 1.8 million infant deaths caused by diarrhea that can be avoided by access to clean water and a lavatory; 443 million days are missed by schoolchildren due to illnesses related to water and almost 50% of the total population of developing countries suffer from, at any given time, some health problem caused by lack of water and plumbing.

Facing this situation, Isofoton thinks daily about how to contribute to the world-wide fight against these problems and in favor of the Millennium Development Goals. Therefore, Isofoton dedicates economic and human resources to the innovation of applications whose use, on a small scale, will mean a major benefit for those communities that are found in rural and isolated areas.

INNOVATING
TO BETTER
QUALITY OF
LIFE

