SITESA

SEMICONDUCTOR TECHNOLOGY

The direct route to

Advanced Epitaxial Technology

Epitaxial CVD reactors
R&D in CVD epitaxy
Silicon epitaxial wafers
Turn-key epitaxial production facilities
Planning and consulting
Supply of process resources and operating material
Comprehensive support

A Member of the Justus Dornier Group

This dedicated, interdisciplinary team of scientists, engineers, and technicians has the expertise to plan, implement and support your project

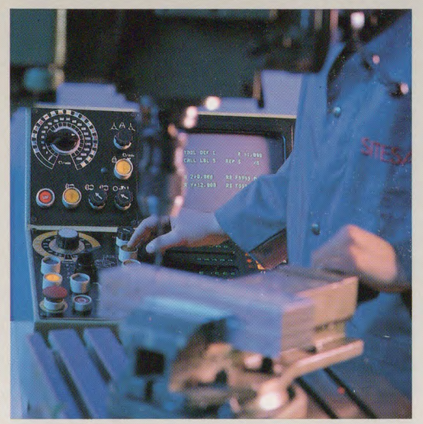
Every individual is an expert in his field with years of hands-on experience in epitaxy; together, they form a successful team equipped with the very latest technical resources.Their objective is to turn innovative reactor technology into reality, to provide comprehensive support and guidance in building complete epitaxial installations.

Responsiveness and flexibility in research & development

SITESA's computer-aided design resources allow us to:

- incorporate the latest technical developments in our products
- update technical documentation without delay
- implement standardization procedures

When we engineer customized installations, our CAD system allows us to adapt the layout to the customer's specific needs.



The underlying objective: quality

The SITESA team applies the ultimate in care and dedication to the systems integration phase. To assure the aggregate quality of the reactor facility we are building for you, each individual component is subjected to a stringent selection process.

Systems integration: a coordinated interdisciplinary effort

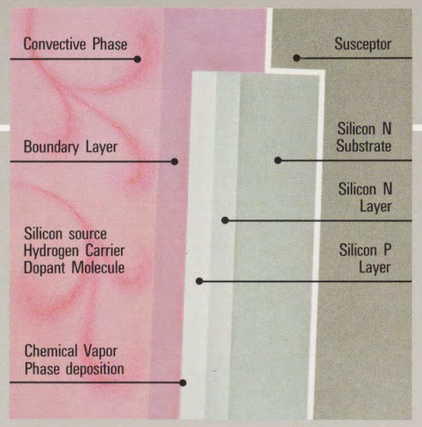
The reactor assembly phase is highly significant. As a general rule, we invite our customers to have their maintenance personnel attend the assembly of the reactor. During the extensive reactor test operation phase at our site, the operators also have the opportunity to undergo training for their future tasks.

We owe our concentrated, up-to-date know-how in epitaxial technology to a highly qualified staff of:

- physicists,
- physicochemical engineers,
- mechanical engineers,
- electronics engineers,
- software specialists, and
- skilled technicians.

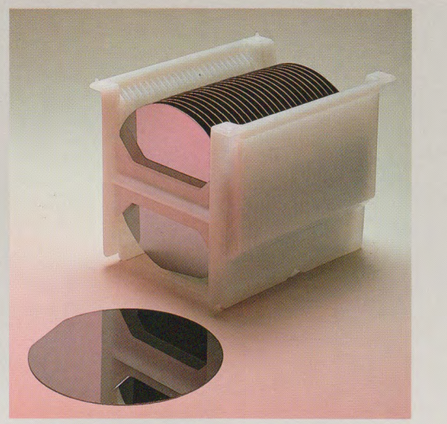
The full scope of epitaxial wafers for device development or production from one source: with no compromise in quality or technology

SITESA's epitaxial service is an important part of the company's overall commitment to epitaxial technology. Rely on us for your production needs or for sample or experimental coatings.



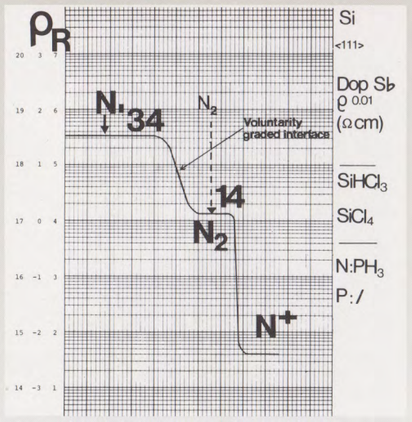
Silicon epitaxial wafers

Epitaxy is the growth of one crystal on the surface of another. In a CVD (chemical vapor deposition) reaction, an ultra-thin layer of silicon is deposited on the surface of a polished silicon substrate.
All parameters which affect the deposition process are tightly controlled. In most cases, the deposited layer is the electrically active film on solid-state components such as MOS and bipolar devices.



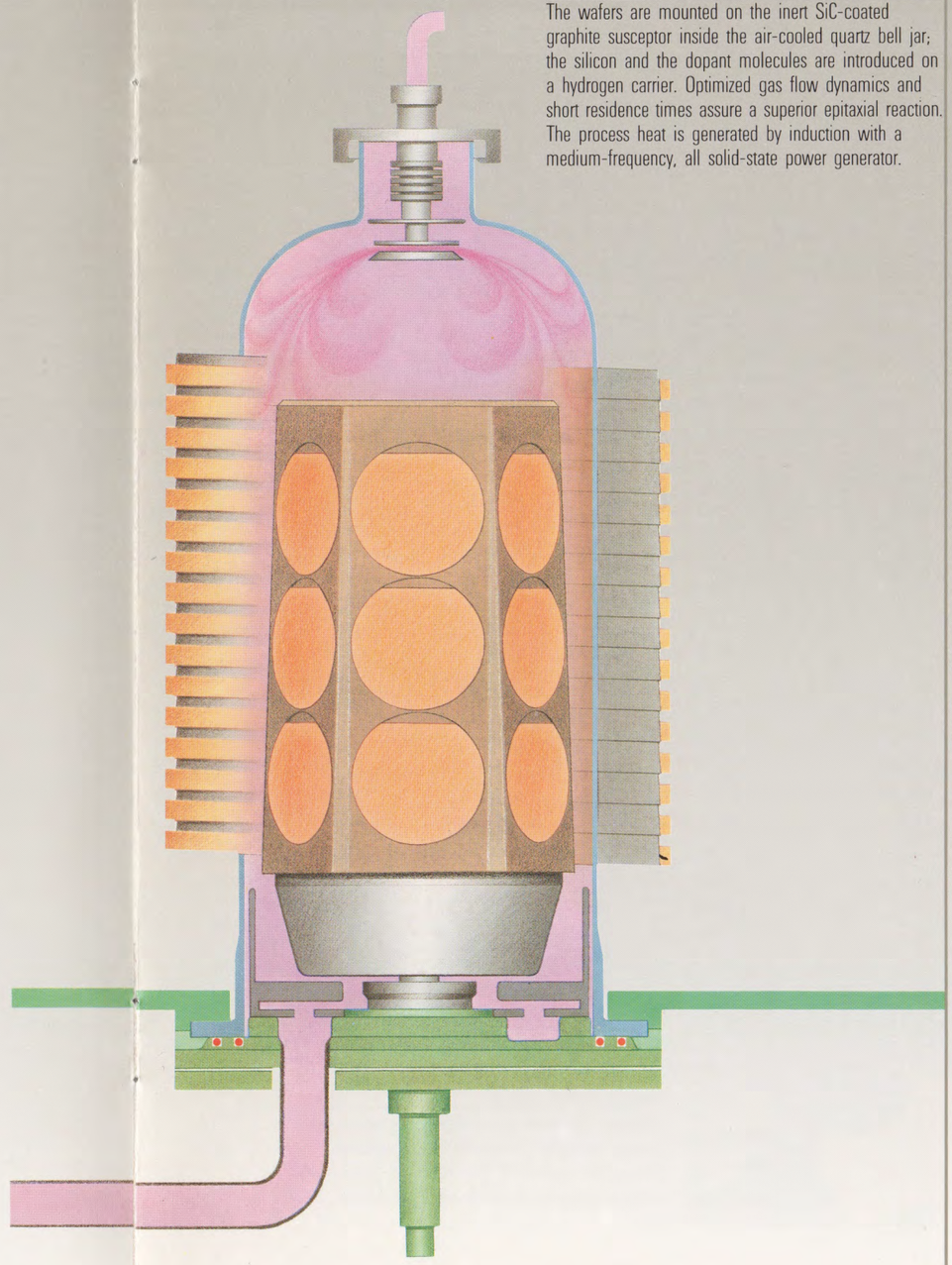
Full epitaxial versatility

SITESA will coat wafers with diameters of 3", 4", 5", and 6" as well as the new 8" (200 mm) format, with single or multilayer structures. Epi-to-substrate transition widths can be fully controlled and layer thicknesses range from 0.5 µm to 150 µm. We also deposit epi films on buried layers.
This sophisticated epitaxial service is available for production batch sizes as well as small development lots.



We don't discuss quality - we assure it

All the epitaxial wafers we ship meet SEMI M2 standards. They are 100% inspected for compliance with epi thickness specifications by infrared spectrointerferometry. Resistivity profiling is performed on every epitaxial run, using four-point or mercury probes. These are very accurate and reproducible methods of non-destructive characterization. Spreading resistance measurements are currently achieved on an AQL basis. 100% visual inspections complement the stringent in-house quality control and quality assurance philosophy.



SITESA's proprietary epitaxial reaction chamber

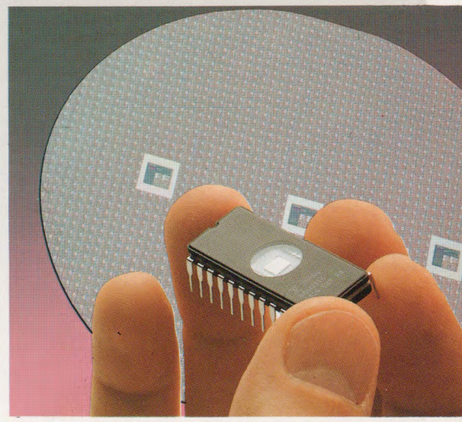
The wafers are mounted on the inert SiC-coated graphite susceptor inside the air-cooled quartz bell jar; the silicon and the dopant molecules are introduced on a hydrogen carrier. Optimized gas flow dynamics and short residence times assure a superior epitaxial reaction. The process heat is generated by induction with a medium-frequency, all solid-state power generator.

Clean packing

The epitaxial wafers do not leave the clean CVD area before they are sealed into the standard containers which maintain clean room conditions. Development quantities are packed piece by piece. No matter where you are, your wafers will arrive in your clean room the same way they left ours: clean.

From the epi layer to the chip

The epitaxial process is one of the fundamental steps in wafer production. Depending on their individual size, one wafer can accommodate anywhere from dozens to thousands of chips with integrated circuits or other semiconductor elements. After the epitaxial reaction, the wafer is diced with a saw.
The subsequent die attach operation mounts each chip on a leadframe that passes through a wire bonder. Finally, the assembly is packaged for use in high-technology applications. Perfect epitaxy is where it all starts.



Our epitaxial operations center:

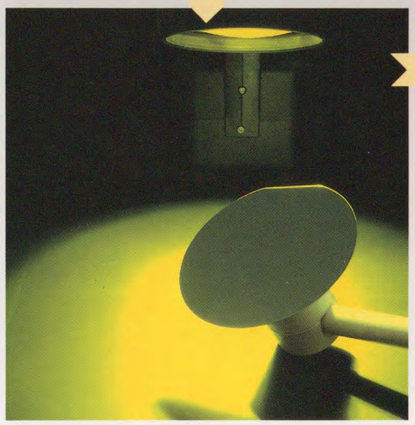
Take advantage of our state-of-the-art facility for your epi production, development and operator training needs

Typically, customers will subject epitaxial wafers supplied by outside sources to more stringent quality tests than wafers produced in-house. To meet this exciting challenge, we have introduced a computer-aided inspection system which maintains run numbers and quality data referenced to each individual shipment.

Fully engineered clean room concept

The clean room system at SITESA is one of the key components of our recognized quality standard and applicational flexibility.
This system features:

- self-contained working zones
- differentiated air pressure zones
- optimized traffic routing
- periodic clean room audits by independent inspectors
- electrostatic charge monitoring



Host Computer

Inspection result feedback to epitaxial reactor

The reactor we use for development and production purposes is always the latest type equipped with the entire range of technical innovations. The effects of these innovations on final quality are carefully monitored. The computer keeps the operator informed on current inspection results to enable continuous adjustment of the epitaxial process to application requirements on a run-to-run basis.
Fast input of wafer measurement data into the process allows us to maintain tight tolerances through the entire order.

Strict epitaxial wafer characterization

The epitaxial layer thickness is measured on each wafer with IR interferometry; additionally, we determine the variation of thickness over the entire surface of a specified number of wafers per run.
Profile measurements of the epitaxial layer carrier concentration (resistivity) are performed with a mercury probe and/or a four-point probe. Spreading resistance measurements allow accurate control of the interfaces between multilayer structures. A comparison between both methods improves the reliability of the final results. A 100% visual inspection covers other important characteristics.

Quality certificates issued

Each wafer shipment to a customer is documented with a quality certificate which lists intrinsic resistivity minima. We file detailed characterization data on each individual wafer; these results are also available to the customer.

Epitaxial operations center rentals

We also rent the fully equipped center for epitaxial research and wafer testing purposes. SITESA offers rental packages of 24 to 80 hours per week, with or without our experienced team of operators and support engineers.

Measurement and quality control data immediately computer processed

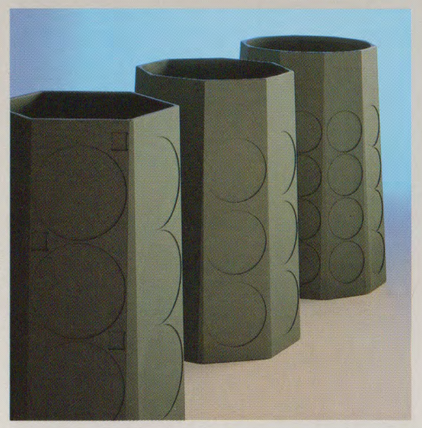
The characterization results are logged into the information management network and processed immediately to allow responsive adjustment of process parameters of the reactor. The daily and monthly statistics yield valuable insights for our work in the fields of reactor engineering, epitaxial plant design, and customer training.

Our pioneering achievement:

SITESA AET 100 - The European Epitaxial Reactor - in a customized configuration and with sophisticated operating resources to guarantee more than 7000 successful epitaxial hours a year

Handling robot

This option is the key to a fully automated epitaxial system. The twin-chamber concept enables automated off-line loading and unloading of substrates. This absolutely clean robot never gets tired and doesn't make mistakes.



A vast array of susceptors

Regardless of the size of the substrate you process, we can supply the ideal susceptor for the application. SITESA susceptors feature:

- ultrapure quality
- perfect uniformity
- optional SiC coatings

Certified, application-tested gases

Today, it is hardly possible to reliably detect the presence of impurities in the primary silicon and the dopant gases. In fact, conclusions on the gas quality cannot really be made until after the wafer has already been coated. Therefore, all the process gases we supply have been previously tested in real epitaxial applications. This approach fully eliminates your risk.

Comprehensive instrumentation

Rely on our application experience in the context of in-process and post-process instrumentation for:

- Layer thickness measurements
- Resistivity profiling
- Crystal quality reviews
- Visual inspection procedures

The process philosophy, the underlying concept, the design and the expertise embodied in the SITESA AET 100 are unique. It is the ideal reactor for cost-effective epitaxial wafer production with superior quality targets. However, the annex facilities we provide - such as test equipment and instrumentation as well as the operating resources - meet the same stringent specifications.

Much more than just another twin-chamber design

The SITESA AET 100 reactor is based on a unique and innovative twin-chamber concept with overlapped cycling.

As soon as the epitaxial process in one chamber has been completed, the system immediately activates the heating cycle in the other chamber. The nitrogen purging and cooldown phase and the susceptor descent step take place while the second chamber is already ramping up to process temperature. The industry's shortest process switchover interval is an exclusive feature of the SITESA AET 100 twin-chamber concept.

For more information on the SITESA AET 100, the European Epitaxial Reactor, we invite you to ask for our separate brochure.

Sophisticated options.

Lines for primary silicon gases
- Silane SiH_4
- Dicholorosilane SiH_2Cl_2
- Tricholorosilane $SiHCl_3$
- Silicon tetrachloride $SiCl_4$

Chamber designed for subatmospheric to atmospheric pressure deposition capability

Completely robotic cassette-to-cassette wafer handling with integrated flat finder

Reactor clean-room configurations standard to-the-wall (mounted flush to the clean room) or optional tunnel concept

Expert system software packages
Easy link-up to host computer

Our epitaxial engineering capabilities:

SITESA can plan and build your entire epitaxial installation, covering all phases from the empty site to production-level startup

SITESA has extensive proprietary know-how in CVD reactor technology and in all facets of epitaxial production. We have the skill and competence to supply turn-key epitaxial production plants or to engineer subprojects in any phase. Your plant will incorporate the accrued experience gained with our own and installed epitaxial production facilities.

How to optimize your project

The cost-effectiveness of an epitaxial plant is not determined solely by the capital expenditure authorized for the installation, but to a great extent also depends on operational considerations such as:

- **reject quota**
- **operating cost**
- **maintenance cost.**

Our interdisciplinary team of experts will plan and optimize your epitaxial plant under consideration of the specific functional requirements, costing strategies and environmental constraints involved in the project. This approach will eliminate cost overrides and disappointment when the plant goes on line. SITESA can design epitaxial production facilities from the ground up or incorporate configurations into existing buildings. from the empty site to production-level startup

Phase 1

Product mix analysis

The layout and cost of an epitaxial plant are tied directly to the intended product mix. Some installations are used universally to produce various devices such as transistors, low-frequency diodes, bipolars, CMDs or photovoltaic cells. Others are dedicated systems integrated into an existing device fabrication line.

Phase 2

Plant design

An epitaxial plant can hardly be described in a bid. Your specific needs are translated into planning fundamentals. One of our experienced coordinators will assume the responsibility for planning your project and assuring that all your requirements are met. He will submit a preliminary report which outlines the attainable results and describes the most suitable layout for the given application.

Phase 3

Equipment selection

Since we operate our own epitaxial production plant, we have the expertise needed to professionally evaluate eligible installations and equipment. At our epitaxial operations center, we can also test equipment under consideration in a real operating environment. You can count on our full support and advice in drafting the final specifications and selecting the equipment.

Phase 4

Project cost analysis

A thorough approach in the planning phase provides reliable costing and scheduling parameters for your project. Financial simulation techniques are available to determine capital spending requirements and unit costs. The information developed in this phase will determine further action.

Phase 5

Project management

When you entrust the management of your project to SITESA, we can guarantee compliance with the budget and timing established in the planning phase.
In addition, we will accept the responsibility for the output and quality of the epitaxial products which the installation has been designed to produce.

Phase 6

Commissioning

The epitaxial plant and its annex installations are carefully commissioned by our highly qualified engineers. The complete involvement of the customer's personnel in this phase is indispensable. This is the prime opportunity for future operators and maintenance crews to gain in-depth awareness of all aspects of the plant's operational characteristics.

Phase 7

Training

The objective of zero-defect epitaxy, cost-effectiveness and optimized device yields require that your personnel be thoroughly familiar with the explicit nature of the process, the quality control procedures, the safety requirements imposed on the handling phases, and with all measures needed to safeguard process integrity from the raw wafer to the completed epitaxial film.

SITESA is professional, single-source epitaxy at its best. Whatever your particular epitaxy project might involve, call the experts. Call SITESA.

With its revolutionary Speed Canard, GYROFLUG GmbH attracted the attention of the international aviation community. The "duck" - an aircraft with full composite structure - designed for civilian applications, was certified in 1983 as the first aircraft of its kind.

DIGITRON AG designs and manufactures integrated material handling systems based on robot vehicles as well as advanced high-bay warehousing facilities for production environments.

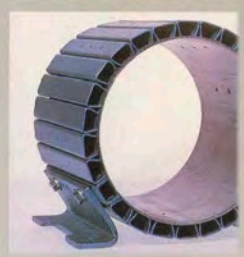
SITESA SA Semiconductor Technology is a member of the Justus Dornier Holding AG, a group of high-technology companies which includes Gyroflug GmbH, Digitron AG, ZWAG Zschokke Wartmann AG and the aircraft division of FFA Flug- und Fahrzeugwerke AG. Each of these group companies is a dynamic leader in its respective field.

SITESA operates ultra-modern production facilities specially created to handle high-technology processes, with particular emphasis on epitaxial deposition requirements.

SITESA headquarters are located in Biasca. This city in the southern part of Switzerland lies on the main international expressway network which links northern and southern Europe. The site is close to the international airports of Zurich, Milan and Geneva, as well as to the local airport of Lugano. The intercity rail service provides convenient links to major business centers.

SITESA SA Semiconductor Technology is a leader in epitaxial reactor engineering; it has an innovative management, qualified and experienced human resources, modern production facilities and a strong financial background. SITESA is geared to technological leadership, competence and sound growth.

ZWAG Zschokke Wartmann AG has developed unique automatic production systems for motor housings; they are characterized by excellent heat dissipation properties, light weight and simple design. The company is also active in the field of specialized food-processing plants, e.g., vacuum-driers.



FFA Flug- und Fahrzeugwerke AG (aircraft division) is the designer and manufacturer of the swiss BRAVO training aircraft for civil and military pilots.
FFA (aircraft divison) operates, on its own airport, a general and military aviation maintenance and repair center. A separate division of the company is specialized in surface treatments for alloyed metals.

SITESA SA
SEMICONDUCTOR TECHNOLOGY

Via Industria, P.O. Box 2
CH-6710 Biasca (Switzerland)
Telephone 092 72 11 46 / 72 34 04
Telex 846 484 site ch
Telefax 092 72 31 51