Antistatic prevention in semi-conductor tools: a new domain at Rood Technology

Uwe Thiemann has worked in the semiconductor industry since 1979. He worked for EM Micro-electronic-Marin SA for the last 12 years until he joined Rood Technology in March 2008, where he is now responsible for the evaluation of electro-static risks in production lines.

At the end of the 90s, he was confronted with the increasing number of customer returns due to ESD damage.
'We had done extensive tests which showed that ESD-related damage could not be explained only by an ESD event through device pins.
In general, it is well known that mechanical friction between a non-conductive material and a conductive material can generate electrostatic charge separation. In some cases this can lead to explosions; a horrific example was the crash of a 747 airliner near New York in the nineties due to an ESD spark within a fuel tank.

Device charging or discharging is also observed in automatic wafer or chip production. Movement of metal on Teflon rails, rolling of plastic carrier tapes, lamination processes, or new device packaging techniques are typical examples.
This type of defect generated by these discharges is called ESDFOS (ESD-from-outside-to-surface). ESDFOS can happen in two ways: either the handler/picker is charged and discharges itself into the device, or, if the device is insulated, it may charge up, and discharge into the grounded handler/picker. This applies also for sawing and cleaning processes where the result may also show up in memory data change without any physical destruction (water electrostatic induction).

So far, mechanisms and geometry influence of such phenomenon is still subject to intensive investigations. Information exchange has mostly taken place at seminars, and further research is ongoing in cooperation with Empa and industrial customers.

So far, this cooperation has resulted in guidelines that customers can use to evaluate their equipment for ESD risks.
We also plan to develop useful measurement equipment that can be combined modularly, which will allow customers to do some of those tests themselves.
The next step will be to prepare a guideline for robotic production equipment manufacturers in order to minimize ESD risks from the outset.
The goal is to develop standardized tool acceptance tests and a certification procedure for suppliers, which will be offered to the market.

I consider it a personal challenge to improve this process and eventually to eliminate failures.
You have to think outside the box and ask yourself what would happen if... I feel like a kind of explorer.'

Here are some examples of the most common causes of ESDFOS:

- Embedding of semiconductor devices into plastic cards (lamination process); unwinding plastic foils generates dangerous charges unless air ionizer bars are used on both sides of the foil.
- In a chip picking machine, the picker head is grounded perfectly, while the diced chips on blue foil are charged up when entering into the handling chamber. Discharge occurs through the grounded picker head. Adding an ionizer to obtain smooth, controlled discharging solves the problem.
- Ultrasonic cleaning processes can introduce an electrostatic charge into a device if the transmission liquids are highly insulating.

Source: Electrostatic discharge directly to the chip surface, caused by automatic post-wafer processing by Peter Jacob, Uwe Thiemann, Joachim C. Reiner.

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ROOD TECHNOLOGY

Dear reader of this Rood Technology newsletter

For this newsletter, we have chosen the theme of failure analysis, and the new activity that Rood has started up in this area: ESD Evaluation (ESD: electrostatic discharge). Failure analysis is the process of collecting and analyzing data to determine the root cause of a failure and how to prevent it from recurring. It is an important discipline in the electronics industry, where it is a vital tool used in the development of new products and for the improvement of existing products. Rood Technology is very active and experienced in this area, and is confident about its prospects.

- The Barometer -

Long-term global growth of 8% in dollars

'So far, the semiconductor industry has not been seriously hampered by the credit crises. Global growth in dollars in the first quarter was between 3-4%, as forecast by a number of reputed institutions.
In the long term, 8% global growth measured in dollars seems to be achievable, keeping in mind that Europe and America will do relatively worse. Growth is mostly driven by Asia.
This means, as far as we can see, that we cannot expect any real production growth in Europe.
Companies are continuing to move parts of their production to Asia, a development which is further fuelled by the strength of the euro against the dollar.
Rood Technology is feeling the decline at Infineon/Qimonda, as well as the negative effects of the weaker dollar, as some 10% of its sales is settled in dollars.
On the other hand, the use of semi-conductors continues to rise significantly, partly due to the development of fabless semiconductor companies.
All in all, we are very positive about our prospects, and we see no reason to modify the expectations we pronounced in the past.'

- Supply chain management -

Fabless semiconductor companies are our potential customers

'This year has started very well for Rood Technology. In the past few months, we have received new orders in the area of supply chain management, and the prospects for next year continue to be very positive. As we have said before, we are convinced that supply chain management and orders from fabless semiconductor companies in general will be the backbone of Rood Technology's business in the future, compensating for decreasing sales to IDMs.

At present, there are some 400–500 fabless semiconductor companies in Europe. These include design houses in the narrower sense, which for example solely develop pre-designed blocks of circuits used in semiconductor devices (which in the semiconductor industry are referred to as 'intellectual property') or which develop their own products. Semi-fabless design companies also come in this category. These companies still do testing, or still have back-end activities in-house, but have decided to outsource production. As many as 50 of these companies are potential customers for supply chain management, and between 100 and 200 are attractive customers in general for Rood Technology.

In addition to focusing on supply chain management in Asia for European customers, we remain alert to opportunities to set up and operate volume testing in Asia for new customers, either in collaboration with local partners or by ourselves.
In terms of supply chain management, we are focusing primarily on our strategic partnership with Millennium Microtech. Nevertheless we are also in contact with other companies so that, where necessary, we can also offer services which are not in Millennium Microtech's range.

Requests for supply chain management are highly diverse, from medium to high-volume projects with mass-market integrated circuits (ICs).
By combining and bundling these, we are able to offer customers attractive rates while still being profitable.
Often, the ICs concerned are designed for sophisticated applications, which demand intensive and close collaboration between the IC developer and the test engineers.
As our development work takes place centrally in Europe, we clearly offer our customers added value. In combination with the assembly activities in Asia, this provides a good basis for our future.'

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- From the inside -

This is the area for our future

We are talking to Ralf Schönfelder, Laboratory Manager Failure Analysis, who joined Rood Technology's Failure and Technology Analysis business unit in January 2004. 'When I joined Rood, I was the second employee in this business unit. At the time, we realized only 1-2% of total sales. After concluding a contract with a large IDM in the area of qualification analysis, the business unit grew rapidly: sales increased enormously, in the last 5 years by about 60% p.a in average. At the end of 2005, there were five employees, and right now we have 10. In 2006 we started up a new activity: chip modification/repair by using Focused Ion Beam (FIB).'

This technique is particularly used in the semiconductor and materials science fields for site-specific analysis, deposition, and ablation of materials. The FIB is a scientific instrument that resembles a scanning electron microscope and uses a focused beam of gallium ions instead of electrons. Gallium ions are capable to sputter atoms from the surface. Because of this sputtering capability, the FIB is often used as a micro-machining tool in the semiconductor industry to patch or modify an existing semiconductor device. For example, in an integrated circuit, the gallium beam can be used to cut unwanted electrical connections or to deposit conductive material in order to make a connection.

'Recently, we have added the activity ESD Evaluation (ESD: electrostatic discharge) at the initiative of Peter Jacob of the Swiss company Empa. (See also the interview with Peter Jacob on page 3 and with Uwe Thieman on page 4).

Ralf sees plenty of growth opportunities in the failure analysis market.
'Almost all automotive IDMs in Europe (Germany, France, Italy, Austria, etcetera) outsource these services. The automotive industry uses more and more electrical devices, for example in airbags, braking systems, cruise control, etcetera.
More products means that more devices can fail, and any failure has to be analyzed. You also see more rechecks being carried out. Because of safety, the time factor is also becoming ever more important. We must track down the root cause of a failure as fast as possible, in any case within eight days. Rood Technology has a good name in this sector. This is the area for our future.

Demand from the consumer market (LCD screens, monitors, laptops etcetera) is also increasing as more devices are being used and quality demands are also rising.'

Ralf is very happy in his current position.
He enjoys discussing customers' problems and finds it a challenge to find solutions. The field he works in is so broad and complex that he and his staff learn something new every day. No analysis is like the first.

The business unit currently focuses on the following activities:

- Failure analysis. Analysis of defective devices is carried out by using physical, chemical and metallurgical analytical methods. These methods are applied to confirm customer complained failures, to detect the area of the defect, to identify failure mechanisms and to initiate corrective actions for quality improvement.
- Qualification-related analysis. This analysis is carried out before and after various qualification tests performed by Rood's own Q&R laboratory to determine the influence of these environmental tests on package and chip-related problems.
- FIB service. This service offers customers the option of making modifications and/or performing analyses at the early stage of development of new devices.
- ESD evaluation/research. Research into the causes of electrostatic discharge in micro components, which appears to occur especially in robotics and assembly lines.

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- From the outside -

A fruitful cooperation

Peter Jacob has been doing research in the field of failure analysis for 25 years.
At present, he works part-time for Empa, the Swiss Federal Laboratories for Materials Testing and Research, and for EM Microelectronic-Marin SA, a semiconductor manufacturer.
He is also an adviser to Rood Technology.

In the mid-1990s he decided to join Empa with his research team, where it is now involved in failure analysis and reliability tests both for components and for subsystems.
'We chose Empa because it had a great deal of experience in mechanics.
Combining mechanical and electrical expertise offers our customers many benefits.
Automotive applications, for example, frequently encounter both electrical and mechanical (reliability) problems in tramcars, trains, trolleybuses or cars.'

Peter explains that the independent institute Empa has created a pool in which particularly companies in the electronics industry participate.
'We offer these companies the option of using our know-how and equipment for ten days per year at a fixed annual fee.
Our customers are mostly constructors and designers that do not have the personnel and equipment to analyse devices or to do reliability engineering. When our workload became too much, we approached Rood Technology to take over some of our work. At the same time, Rood is also in the pool, so it can use Empa's equipment at favourable conditions. As equipment for failure analysis is very expensive, this enables Rood to make significant cost savings. Personally, I hire myself out to Rood as a consultant on a contract basis. This situation creates a high degree of knowledge exchange.'

Peter feels that the collaboration has been very fruitful, and cites as an example the research into the causes of electrostatic discharge in micro components, which appears to occur especially in robotics and assembly lines. A great deal of pooled research into this phenomenon is being done (see also the interview with Uwe Thieman on page 4). Peter is confident about the future workload in this field and performs also seminars and on-site trainings on ESDFOS-tool-dispositions for both Rood-employees and their customers.

- Shareholder information -

Financial agenda

8 July 2008	Publication half year sales figures 2008
7 August 2008	Publication half year figures 2008
7 August 2008	Conference call for press and analysts
13 November 2008	Publication trading update
12 January 2009	Publication full year sales figures 2008
26 February 2009	Publication annual figures 2008
26 February 2009	Conference call for press and analysts
12 March 2009	Publication annual report 2008
26 March 2009	Annual general meeting of shareholders

Empa is an interdisciplinary research and services institution for material sciences and technology development.
Empa's research and development activities focus on meeting the requirements of industry and the needs of society, and link together applications-oriented research and the practical implementation of new ideas, science and industry, and science and society.

At its three sites Empa has available the most modern laboratory facilities and the very latest analytical techniques. Coupled with the experience and know-how of over 800 staff, accumulated in its numerous laboratories over the institution's 125-year history, the company constitutes a powerful analytic tool with outstanding infrastructure.