

"Power and RF should be priorities for European collaboration in chips"

The Chip Integration Technology Center started with lead customers Ampleon, Nexperia and NXP, and is now courting material suppliers for packaging applications. In the next phase, CITC aims to commit manufacturers of back-end assembly equipment.

René Raaijmakers

Barely established, the Chip Integration Technology Center (CITC) in Nijmegen was hit by corona. Not very practical for an organization that relies primarily on knowledge from its network. After all, development work not only takes place in the CITC labs in the Netherlands' oldest city but also at the radar specialists of TNO in Rijswijk, TNO-Holst in Eindhoven and the countless facilities of customers. The latter can often be found within walking distance, at Ampleon, EPR, Nexperia, NXP, PinkRF and Sencio on the Novio Tech Campus.

Nevertheless, CITC already is working with a few dozen partners. Four program lines are running: high power, RF, additively manufactured packages and integrated photonics. Time to catch up with Barry Peet, general manager at CITC since its inception.

What's a new development center doing in a field where established – mainly Asian – players have been calling the shots for decades and where China, Korea and the Philippines do the lion's share of the world's packaging? Together, the players in outsourced assembly and test (OSATs) do about 50-60 billion dollars, depending on which market analyst you talk to.

Peet says that the need for back-end development became clear when he, as director of the Business Cluster Semiconductors network (now Holland Semiconductors), asked his members about their technology and knowledge needs. "We very quickly arrived at the back-end. The packaging of chips is largely done in Asia, but European companies, in particular, need new technology for integration and packaging."

What's your focus?

"In the semiconductor manufacturing chain, the value is increasingly shifting to the back-end. Europe as a whole focuses more on specific technologies like high power and high frequencies. For example, the energy transition requires chips that can handle high power densities. CITC is focusing on the packaging issues that this entails."

"The back-end can't be separated from the semicon value chain. End customers, IDMs like Ampleon and NXP, need it. In addition, material suppliers and machine builders play a big role in the development of solutions. In the Netherlands, there's a great strength when you look at semicon equipment. The knowledge and experience that has been built up in the high-tech ecosystem around ASML in the area of super-precise positioning can also be used for the back-end, which is now growing strongly. Accuracy plays an increasingly important role."

Can you give an example?

"Chips for electrical conversion. In the power domain, converters for electric vehicles, wind turbines and solar parks are needed. Nexperia supplies chips for that. In many cases, chips for communication infrastructure have the same requirements. Ampleon's base station RF chips, for example, must be able to withstand high currents. If you're going to electrify everything, you need to be able to control currents. The whole energy transition depends on high-power chips to make it happen. In that domain, we're working on the right material choices. You want to use non-toxic, lead-free materials for that."

You have the ambition to become the Imec of the back-end. You started with the IDMs Ampleon, Nexperia and NXP, and are now talking to material suppliers. What's the status of that?

"The talks to involve material specialists are at an advanced stage. We're looking for partners, not suppliers. We want to look for real solutions in development programs. Because of Covid and because most of the material suppliers are not from the Netherlands or even Europe, it takes somewhat longer. There's a lot to do. In the high-frequency domain above 100 GHz, for example, many materials have not yet been characterized."

"Getting into CITC means that suppliers do have to dare to be open, share knowledge and be willing to co-invest in development. They get a lot in return. In a normal customer-supplier relationship, customers send their materials back without giving a reason if it doesn't work. When they partner with us, they get substantive feedback to improve their products."

Why is photonics a separate theme?

"From the start, we've been working on packaging for photonics components. In doing so, we're cooperating with Phondelta. The electronics and photonics worlds are quite different. We need to use the Dutch IC packaging knowledge and experience to create an acceleration in photonics."

"Within the Podium consortium, we're working with Phix, Tegema and PI on the active alignment of optical fibers in packaging. German PI brings in positioning technology and Tegema – soon to be Etteplan – develops the micro-assembly machines. Phix has the role of OSAT,



"Dutch knowledge in the area of super-precise positioning can be used to strengthen the back-end activities," says Barry Peet, general manager at CITC in Nijmegen.

the factory where customers can have their optical packages assembled. Unlike electronic chips, optical bonding often involves active alignment. In this process, you align fibers as the light passes through them. You need a feedback loop to get to the correct position. That's the only way the alignment will be accurate enough. The big challenge is speed. Ten seconds per chip is too long."

The Netherlands is participating in a new European research program in the field of microelectronics, for which substantial amounts of money (the so-called IPCEI funds) are being used to catch up in specific market segments. Where should the priorities lie?

"We're very actively involved in IPCEI. For the back-end, I see two directions. One is photonics, a very new field with new challenges in which the Netherlands is well ahead. With the knowl-

edge of machine builders and IDMs, we can give photonics a swing in the back-end. The Netherlands will not become big in 3D stacking of chiplets anytime soon; we need to focus on specific domains such as the high-frequency and high-power domains."

Dutch back-end equipment company Besi is starting to supply the machines for hybrid bonding to TSMC and Intel, who are currently investing billions in advanced packaging technology. Besi and Applied Materials started a development center for emerging chip-to-chip interconnect technology in Singapore. Can the Netherlands play a bigger role there with its precision engineering knowledge?

"We have the knowledge, but the Netherlands alone can't compete with Asia and the US. We have to work at

a European level. An IPCEI program could accelerate that, for example. In our country, we have small specialized OSATs such as Sencio in Nijmegen and Phix in Enschede. OSATs like ASE and Amkor do the large volumes in Asia. We should, for instance, focus on wafer-level packaging or other very specialized packaging and integration domains for specific areas. I do see an advanced packaging fab in Europe or perhaps in the Netherlands as a chance to catch up. The current installation of a front-end 300-millimeter wafer fab by Bosch in Dresden proves Europe's strength in specialized semiconductor domains."

This article was written in close collaboration with CITC.