Adapting to change

From humble beginnings, the Belgian company Xenics has grown to become one of the world's leading suppliers of short-wave infrared cameras outside the US. Nadya Anscome finds out how the company has survived the economic crisis by changing its business strategy and continually developing its products.

When Bob Grietens set up Xenics in 2000, he knew there was a market for the firm's infrared imaging chip technology. He also knew that this technology would enable the realization of many new applications, but he could never have predicted that his company would benefit from the swine flu pandemic of 2009. Today, Xenics' infrared cameras are being used in airports and government institutes in Asia and the Middle East to detect elevated body temperatures and symptoms of fever in travellers.

The camera enables large crowds of people to be monitored without disrupting the flow of pedestrians. It can monitor temperature differences as small as 0.05 °C, and is totally harmless and non-intrusive.

Grietens, who formed the company out of the Belgian microelectronics research institute IMEC, says this is just one of the many applications that would not have been possible without the company's ability to rapidly adapt to new market requirements. "Our uncooled microbolometer cameras are ideal for this application because of their on-board intelligent image-processing, which allows faster decisions to be made," says Grietens.

Xenics started out as a manufacturer of imaging chips, originally aiming at only the scientific market. Today, however, the company has changed considerably and now concentrates on selling both cameras and complete systems in a variety of markets (Box 1). "As well as scientific applications, our markets include modules and components, system integration, and industrial and security applications," says Grietens. "The security market is relatively new to us and we are seeing considerable growth in this area. The semiconductor industry has also been an important customer for our systems, but growth at the moment is limited by the economic climate."

Like so many high-tech companies, Xenics has felt the effects of the recession and admits that repeat orders have decreased. But Grietens believes that the company's strategy of diversification will see it through tough times. "We went through a downturn in 2002, but back then we were not really selling products yet," says Grietens. "Today, we are involved in so many markets that a slow-down in one market is usually matched by growth in another, and new applications are emerging all the time."

Grietens admits that this year he is not expecting the 35–60% annual growth that his company has been experiencing since its inception in 2000. However, a lot has changed since then. "Back then, we were a company that focused on chip-level technology and selling sensors," says Grietens. The company originally aimed at high-volume, low-margin markets because the technology allowed for high-volume production of chips on large substrates. "We soon realized, however, that it was better to make cameras, thereby profiting from high-margin, low-volume markets," says Grietens. As well as producing cameras, the company also carries out system integration and custom engineering, and Grietens believes that, in the long-term, this will further increase the company's strength. "These are added-value markets, which are applications-driven rather than technology-driven," he says. "We also have to aim at markets higher in the 'food chain', such as the security industry."

Xenics' ability to adapt and change according to demand is one of the
Box 1 | Crack detection in the solar-cell industry

Short-wave infrared imaging can "see through" a silicon wafer, therefore allowing inspection of defects and failures that cannot be detected and visualized by other methods. For solar cells, characterization techniques based on electroluminescence can provide spatially resolved information about their performance.

Solar-cell electroluminescence is the emission of light that results when a forward bias voltage is applied to a solar cell. The electrons injected into the solar cell recombine with existing holes in the material, and the energy released by this process is emitted in the form of a photon. These photons have wavelengths in the near-infrared (0.75–1.4 μm) and the short-wave infrared (1.4–3 μm). Electroluminescence imaging takes advantage of the radiative recombination of excited charge-carriers. The emitted photons can be captured with a sensitive camera to obtain an image of the distribution of radiative recombination in the cell.

Using electroluminescence, a short-wave infrared InGaAs camera can be used to test the uniformity of all types of photovoltaic cells, including thin-film silicon, mono- and polycrystalline silicon, cadmium telluride and cadmium indium gallium selenide. The emission directly correlates to the solar-collection efficiency.

Electroluminescence imaging can be used for the detection of cracks, grain boundaries, broken contacts and shunts; the mapping of series resistances; and assessing the quality of solar-cell material by obtaining the distribution of diffusion lengths of minority carriers.

Bob Grietens, founder and CEO of Xenics, believes InGaAs cameras have many advantages over conventional CCD cameras, which are the usual choice for luminescence imaging applications.

"Scientific-grade silicon CCD cameras have to be cooled significantly to reduce noise and dark current levels, whereas our cameras need no cooling," he says. "Also, silicon-based CCD cameras, with a cut-off wavelength at 1.100 nm, will only detect the short-wavelength tail of the band-to-band luminescence from silicon solar-cells at room temperature. By using a short-wave infrared InGaAs camera, about an order of magnitude enhancement in the measured photon flux can be achieved."

Bob Grietens, CEO of Xenics.

wavelength range, its quantum efficiency is 80% and, for some applications, it can achieve imaging at 10,000 frames per second.

"Such development is very complex because a lot of data must be processed before you can get an image," says Grietens. "The Cheetah product is an example of our capabilities at Xenics. Our high-speed InGaAs detector has a lot of outputs. All of this data coming out of each output needs to be processed in parallel."

Its speed makes the Cheetah ideal for applications such as free-space communication or in adaptive optics, where it is being used to correct for atmospheric turbulence in imaging systems. The high-speed camera, mounted behind a Shack-Hartmann sensor to measure the wave distortion, provides active feedback to the deformable telescope mirror and thus results in a corrected wavefront at the high-speed demodulator.

Other applications for this high-speed camera include tracking free-space optical lasers, identifying gunshot signatures, and medical applications such as optical coherence tomography (OCT). "In OCT, rapid image-acquisition is limited by the necessity for mechanical scanning when using time- or spectral-domain OCT," says Grietens. "However, when using a high-speed 2D-imaging camera, full-field OCT can be achieved without mechanical scanning."

From humble beginnings, Xenics now employs around 50 people and is certainly among the photonics industry’s success stories — many companies set up around the same time as Xenics have since disappeared. But Grietens knows there is still work to be done. "There is always room for improvement," he says. "We are aiming for new products in new applications and want to keep investing in the company for it to grow in the future."

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