**Case study**

Imaging through semiconductor material

Allied Vision’s short-wave infrared (SWIR) cameras are used in IR microscopy to detect defects during semiconductor fabrication process.

Electronic devices have become very common in today’s modern society. Chances are everyone may have come across and utilized a silicon wafer indirectly with their usage of electronic devices.

**Silicon, the core material of semiconductors**

Wafer is a thin substrate of semiconductor material which is used in electronics for integrated circuits fabrication. There are many types of semiconductor materials and one of the most commonly used semiconductor material in electronics is Silicon (Si).

Silicon wafer is a key component in integrated circuits. It is formed from highly pure, nearly defect-free, monocrystalline silicon thinly sliced from a silicon boule. It serves as the substrate for microelectronic devices built in and over the wafer. The wafer undergoes many microfabrication process steps such as masking, etching, doping, and metallization.

Integrated Circuit has become the principal components of almost all electronic devices. Integrated circuit, commonly referred to as an IC, is a microscopic array of electronic circuits and components that has been implanted onto the surface of a single crystal of semiconductor material such as Silicon (Si). It is called integrated circuit because the components, circuits and base material are all made together out of a single piece of silicon wafer. Hundreds of integrated circuits are made at the same time on a single, thin slice of silicon wafer and then they are cut apart into individual IC chips.

**Silicon cracks jeopardize end-product quality**

Wafers accumulates residual stress during the growth, sawing, grinding, etching and polishing process. Cracks may be generated throughout the process, and if undetected, the wafers that survived can be rendered unusable in subsequent manufacturing stages. Cracks may also happen when the integrated circuits are cut into individual IC. Therefore, inspecting the raw material substrate for impurities before processing and detecting defects during processing is critical to keep the costs down.

**Infrared imaging detects cracks inside silicon substrate**

Silicon has the property to be transparent to infrared light. As a result, Indium gallium arsenide (InGaAs) cameras, operating in the SWIR (short-wave infrared) wavelength band from 0.9µm to 1.7µm, allow users to see through semiconductor silicon substrates. The ability to see through these semiconductor materials offers great benefit to the manufacturing process because infrared images highlight defects such as cracks inside the silicon wafer.

Radiant Optronics, a technology company headquartered in Singapore, is specialized in applying the latest technology developments to failure analysis applications with a strong focus in the Semiconductor field, wafer fabrication, service laboratories, packaging and PCB assembly in Asia. The company’s diverse customer base includes organizations in the Electronics, Semiconductor, R & D Institutions and BioTech sectors.

Manufacturer of integrated circuits (IC) use Radiant Optronics’ Infrared Imaging Microscopes fitted with Allied Vision’s SWIR camera, Goldeye G-008, to inspect the IC for internal defects or cracks which might happen during the manufacturing process.

**Goldeye G-008 delivers best price-performance ratio**

Allied Vision’s Goldeye models are short-wave infrared cameras (SWIR) building on high performance InGaAs sensors which are designed to fulfill the highest industrial standards. All Goldeye cameras are equipped with an active thermos-electric cooling device (TEC1) to delivery low-noise images regardless of the ambient temperature. Their robust, compact housing with fan-less cooling system provides multiple mounting option for easy system integration.

“The Goldeye G-008 is a low-resolution model with an affordable price. The low resolution is sufficient to detect the defects, so it is the ideal choice for this cost-sensitive application. Our customers can benefit from the Goldeye’s outstanding performance and we enjoy support from Allied Vision’s Asia-Pacific office just next door in Singapore.” stated Christopher Cheong, Director of Radiant Optronics, as further reasons for selecting Allied Vision SWIR cameras.

With increasing demand of electronics in society, semiconductor fabrication plants and integrated circuit manufacturers are manufacturing higher quantities of wafers and IC to fulfill the demand. The escalating demand is driving the industry to use advanced imaging technologies for quality control. This is critical to keep the costs down. The Goldeye G-008 is the fastest 1/4-VGA resolution short wave infrared camera (SWIR) with GigE Vision interface. With frame rates up to 344 fps at full resolution, versatile application fields can be addressed, and manufacturing processes can be improved tremendously.

**Profile of Allied Vision**

For over 25 years, Allied Vision has been helping people to see the bigger picture. Allied Vision supplies camera technology and image capture solutions for industrial inspection, science, medicine, traffic monitoring and many more application areas in digital imaging. With a deep understanding of customers’ needs, Allied Vision finds individual solutions for every application, a practice which has made Allied Vision one of the leading camera manufacturers worldwide in the machine vision market. The company has eight locations in Germany, Canada, the United States, Singapore and China and is represented by a network of sales partners in over 30 countries. [www.alliedvision.com](http://www.alliedvision.com)

**Contact (Company Headquarters):**Allied Vision Technologies GmbH | Taschenweg 2a | 07646 Stadtroda, Germany  
Tel.: +49 36428/677-0 | Fax: +49 36428/677-24 | [info@alliedvision.com](mailto:info@alliedvision.com) | [www.alliedvision.com](http://www.alliedvision.com)

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| **Media Contact:** |  |
| Jessica  Allied Vision Technologies Asia Pte. Ltd.  82 Playfair Road  #07-02 D'Lithium  Singapore 368001  Tel.: +65 66349027  Fax: +65 66349029  [jessica@alliedvision.com](mailto:jessica@alliedvision.com) |  |