Semiconductor Development Utilizes Real-Time Analysis

Integrated circuits are manufactured by depositing materials in layers on a wafer substrate composed typically of silicon or gallium arsenide. The physical characteristics of the substrate of each thin-film layer are critical for the successful implementation of chip design. Hours and even days can be lost if an integrated circuit is implemented on a faulty substrate or thin-film layer.

To verify the integrity of the substrate, as well as the preciseness with which subsequent layers of material are deposited on it, electron beam diffraction technology is often used. Referred to as RHEED (Reflection High-Energy Electron Diffraction), an electron beam is targeted at a wafer contained in an ultra-high vacuum chamber. The beam impinges on the wafer surface, diffracts off it, and hits a phosphor screen, creating a diffraction image. By capturing and analyzing this image, it is possible to discern the structural integrity, thickness, and rate of deposition in the chip that is being manufactured.

k-Space Associates, a systems integrator in Ann Arbor, MI, has developed a major improvement to the electron diffraction technique. The kSA 400 is a PC-based system that enables scientists to measure the film growth in real time and quantifies such information as surface perfection, thickness, growth rate, and atomic spacing.

The heart of the system is a PC running Microsoft® Windows®. A Data Translation MACH Series™ PCI frame grabber (DT3152, DT3155, or DT3157) installed in the computer captures the images from a camera. Custom software developed using Data Translation's Frame Grabber SDK™ software development tools are used to monitor the process.

k-Space selected Data Translation frame grabbers because of their scientific-quality accuracy, necessary for the detailed measurements required. The Frame Grabber SDK allowed k-Space to meet customers' special requirements by using different Data Translation frame grabbers as needed - without re-writing existing code. Together they enabled the kSA 400 to be the first commercially-available system to acquire and analyze the phosphor images generated by the RHEED process. Semiconductor manufacturers using the system are saving time and development costs because they are able to quickly extract much more useful information during testing.

For more information, click on DT3152, DT3155, DT3157 or call (800) 525-8528.