Inspection Device Improves Semiconductor Wafer Reliability

Payoff

The technology developed for the unpatterned wafer inspection will allow semiconductor equipment manufacturers to advance into market areas that require increasingly smaller chip line widths. This tool will yield a higher reliability factor for the inspection of unpatterned wafers, fewer defective production chips, less waste and lower costs. Successful transfer of this technology could also lead to higher quality and lower costs in the commercial sector.

Accomplishment

An innovative research effort sponsored by the Air Force Research Laboratory's (AFRL's) Materials and Manufacturing Directorate (ML) has led to the successful development of a revolutionary technology that can detect sub-micron contaminant particles on unpatterned semiconductor wafers. Sentec Corporation, under a Small Business Innovation Research (SBIR) program contract, developed technology for use in a pre-fabrication environment to qualify wafers or monitor the fabrication process. The new inspection device yields higher reliability, fewer defective production chips, less waste and lower costs, while strengthening the U.S. defense industrial base.

Background

As semiconductor makers continue to reduce the size of chip features, continually smaller contaminant particles assume the characteristics of “killer” defects. According to the Sematech national technology Roadmap for Semiconductors (November 1997), the line width of state-of-the-art semiconductor chips is expected to be 180 nanometers (nm) in 1999 and will continue to decrease in size until line widths reach 100 nm in 2006. At line widths of this size, a “killer” defect particle would be only about 33 nm in diameter. Current scatterometer wafer inspection devices rely on the detection of the intensity of energy backscattered by contaminant particles making the detection of particles smaller than 80 nm difficult, time-consuming and expensive. Sentec’s technology presents a solution to that problem, i.e., the device does not attempt to detect the intensity of energy backscattered from the contaminant particles, but instead detects the amplitude of the electo-magnetic field of the backscattered energy. This approach vastly improves detection sensitivity and allows the Sentec device to meet the future needs of the semiconductor industry by detecting much smaller contaminant particles at a throughput rate high enough to support in-line monitoring of semiconductor wafer processing. Sentec’s device can also provide spectral information, which can be used to identify the contaminants on the wafer.