Center for Microcontamination Control (CMC)

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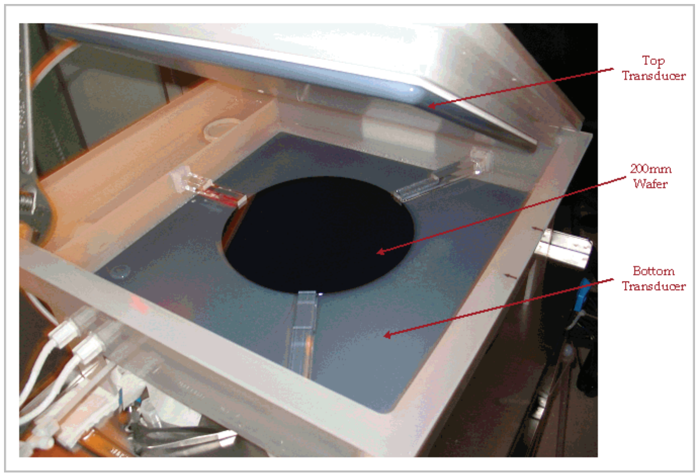
Physical Removal of Nanoscale Particles from surfaces and trenches



Researchers at the Center for Microcontamination Control (CMC) have developed a substrate independent technique for the removal of nano particles (down to 26 nm) from large areas in a very short time (less than a minute). The technique uses high frequency acoustic streaming in a specially designed tool by CMC researchers. The technique has also been shown to be capable of efficiently removing nanoparticles from deep trenches (as deep as 500 microns). This is the first time that such removal from trenches has been directly demonstrated. The technique has been applied to semiconductor wafers, hard disk media and head, and flat panel displays and is the first demonstration of substrate independent removal of nanoparticles. These techniques enable companies to remove nanoscale particles without any effect on sensitive substrates. The techniques are based on reductions of the boundary layer thickness from thousands of microns to submicron levels. They allow even low velocities to remove nano particles and opens the field to many other applications that requires a high shear velocity near the surface. A patent has been filed and a member company (PCT Systems) already made two prototypes. Another member company (Seagate) is ordering an additional prototype to evaluate for their fabrication development based on our results in removing manufacturing defects.

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Observing Bacteria on the Inside Walls of Ultrapure Water Pipes

A decade ago, the Center for Microcontamination Control sponsored work that lead to Polymerase Chain Reaction (PCR) amplification of DNA in ultrapure-water-born bacteria. Eventually, a process was developed that would measure one bacterium in one liter of water. Subsequently, it became apparent that most of the bacteria reside on the walls of the ultrapure water piping in concentrations of 10,000 to 1,000,000-times greater. The process of semiconductor process contamination results when small areas of the bacterial colonies or biofilms are released from the surface at infrequent and random intervals. Once this concept was understood, it was realized that the primary issue is detecting the nucleation and growth of bacterial films on the piping materials used in the distribution of ultrapure water. The breakthrough was the development of a new and novel technology that can monitor and detect growth of surface bacterial films. This technology can be made so sensitive that it can detect the protein substance that must deposit before the first layer of bacteria attaches to the piping walls. It can also be made less sensitive for less demanding applications.

> **Economic Impact:** This device will be of most use in the pharmaceutical industry, where bacterial monitoring is now coming under more scrutiny and is more serious than in the semiconductor industry. The CMC is currently working with a small business to develop and manufacture this detector.

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