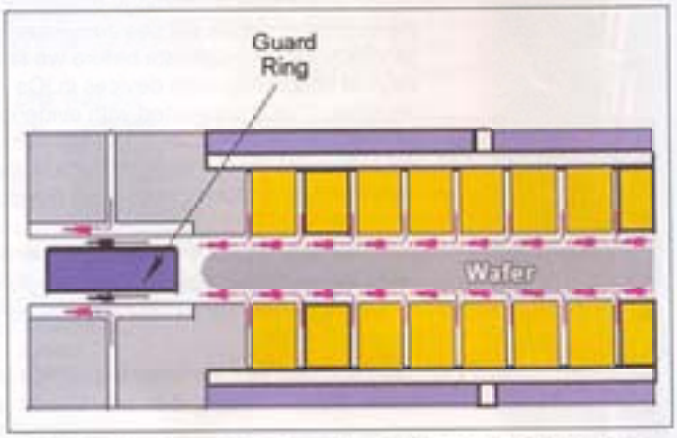
Novel Annealing System Developed for Chip Makers

Pan-European collaborative work led to the development of a revolutionary new annealing technique for wafer fabrication. After wafers have been implanted with high-energy ions, rapid thermal annealing (RTA) is required to repair the semiconductor crystal structure. RTA requires very rapid changes of temperature under accurately controlled conditions for satisfactory annealing. This annealing is conventionally accomplished by focusing the heat from a bank of tungsten filament lamps onto the wafer surface, as furnace heating involves long process times. However, rapid cooling is difficult to achieve.

In the new RTA system, the heat is supplied by conduction rather than by radiation. The semiconductor wafers are precisely floated between two hot graphite blocks, coated with silicon carbide and kept at the process temperature. A stream of hot nitrogen or helium gas emerges from narrow channels in the blocks to ensure that the wafers are heated and cooled very rapidly and very uniformly across their surfaces. Faster heating and cooling rates and better temperature control can be obtained than with conventional RTA systems. The system is also very suitable for rapid thermal oxidation, even though the oxidation application is not completely ready yet.

The new RTA system can be used at up to 1100°C with heating rates of up to 900°C per second with helium and a high wafer throughput. This 'Levitor' machine is available from ASM International (ASMI) for annealing silicon after ion implantation and for the very fast heating of conducting layers. Power consumption is only 6-20kW for a 300mm wafer system, whereas tungsten filament RTA requires 200-250kW. It has been qualified for 65nm chip technology and qualification for 45nm is commencing. A simpler, more economical, version is available for use at up to 400°C.



Principle of 'gas-bearing' between two high-mass blocks that act as a thermal flywheel

The results of this project should provide Europe with a global lead to boost employment in manufacturing equipment.

The partners who developed the new system are ASMI, ASM Belgium, CEA-LETI, IMEC, Schunk, STMicroelectronics and Xycarb Ceramics. This Medea+ project, dubbed T303 Contactless Anneal And Silicides System (CLASS), was carried out in Belgium, France, Germany, Italy and The Netherlands. It is one of 34 completed projects of the 70 projects under the Medea+ umbrella.

The Medea+ programme involves 350 partners from 21 European countries and the work of 14,000 person-years.

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New market report by Nexus (the EC-backed Network of Excellence in Multifunctional Microsystems) forecasts the MEMS market to reach $25bn in 2009, which is more than double on 2004. The *"Nexus Market Analysis for MEMS and Microsystems III, 2005-2009"* report states that MST/MEMS sensors and actuators will still remain an important element of the IT peripheral market for read/write heads and inkjet heads, but also enter new areas such as microphones, memories, micro energy sources and chip coolers.

Seagate's nanotechnology facility in Springtown, Northern Ireland, has received a financial boost of £83m, which it will share with sister plant Limavady, also in Northern Ireland. Between the two, some 300 new jobs will be created. The investment includes backing of £24.8m from Invest Northern Ireland, the main economic development agency there.

University of Surrey's Advanced Technology Institute (ATI) and CEVP have started trials of the world's first tool for low temperature carbon nanotube growth.

The partners envisage releasing the technology – called NanoGrowth – for commercial use in March this year.