# Trenches create memory space

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The 300-mm wafers are coated with an etch-resistant film in the cleanroom. Currently being tested: Masks made of aluminum nitride instead of silicon dioxide. © Fraunhofer IKTS

The requirements are tightening up. Computers are having to become more and more efficient. A new technology boosts memory capacity: etching the silicon wafer creates deep trenches that increase its capacity to store data.

Computers are required to become more and more efficient. Inevitably, this involves greater demands on memory devices as well: they should be as small, strong, fast, and economical as possible – and always stay cool, if you please!

Only memory modules – known in technical terminology as DRAM –

which outstrip their rivals in these areas, have any chance of a future career in PCs, laptops, mobile communications, the entertainment industry and the gigantic server parks of Internet service providers. The memory business generates a worldwide sales volume of 25 billion dollars a year.

The pressure to innovate is relentless, and only manufacturers with the best technologies and the most efficient production methods can survive. The world's second-largest supplier in the hotly contested DRAM market is the Dresden-based chip manufacturer Qimonda. The new company, a wholly-owned Infineon subsidiary, currently produces memory components based on 90-nanometer technology, and is striving to be able to etch structures only 65 nanometers wide on the silicon wafers in the not-too-distant future.

Qimonda is supported by engineers at the Fraunhofer Institute for Ceramic Technologies and Systems IKTS in Dresden. The team of researchers led by Tobias Mayer-Uhma, Falko Schlenkrich and Ingolf Endler has developed a new etch-resistant film that will make it possible to produce deeper and narrower "trenches", for it is this that makes the vital difference in memory chip production.

After a series of complex processing steps such as photolithography, etching and polishing, an etch-resistant silicon dioxide film, known as the "hard mask", is applied. This film contains the structures into which the trenches are later etched using an etching gas. Subsequently filling up such a trench with dielectric material produces a capacitor. The deeper the trenches are etched, the more wall surface is available and the greater is the capacitance.

"We provide the technology for manufacturing and etching these masks," explains Mayer-Uhma. In order to etch increasingly deep trenches, the Fraunhofer researchers are developing and testing more

reactive gas mixtures along with correspondingly more robust mask materials. Masks made of aluminum nitride – which is five times more resistant to etching gas than silicon dioxide – are currently being tested at the team's own modified vapor deposition facility.

Source: Fraunhofer-Gesellschaft