SiGe:C scales speed

Hitachi Ltd's Central Research Laboratory (Tokyo, Japan) has developed a prototype SiGe:C HBT with performance of 144 GHz and $f_{\text{max}} = 174$ GHz.

SiGe's performance deteriorates quickly after heat treatment when integrated with CMOS, according to ULSI Research Department senior researcher Katsuyoshi Washio. When an SiGe base is scaled down, the boron dopant migrates by diffusion through the base layer of the bipolar transistor during thermal processing, creating a fuzzy boundary for the base. Depositing a small amount of carbon in a SiGe:C layer prevents boron impurity diffusion. But developers have previously proved unable to fabricate SiGe:C HBTs with self-aligned epitaxial growth processes.

Firstly, Hitachi used ultra-high-vacuum CVD selective epitaxial growth to form a single SiGe:C crystal only on the silicon substrate. The SiGe:C, containing about 15% germanium and 0.4% carbon, is boron-doped at a concentration about four times higher than standard doping concentrations. Following etching, the much faster deposition rate on silicon limits deposition to the silicon substrate.

Secondly, a self-aligning fabrication process technology, using selective epitaxial growth, eschews the need for an extra mask over the active area of the transistor.

Hitachi targets first commercial devices in 2002.

InP to boost radio telescope

TRW Inc (Redondo Beach, CA, USA) and Australia’s Commonwealth Scientific and Industrial Research Organisation (CSIRO) have allied to develop GaAs and InP components for radio astronomy, advanced millimetre-wave sensors and telecoms systems.

Velocium - part of TRW Inc’s TRW Space & Electronics operating unit - has already fabricated CSIRO-designed InP low-noise amplifiers and digital receiver chips for upgrading its Australia Telescope (the Southern Hemisphere’s premier radio telescope) to operate at frequencies of up to 100 GHz and has just produced detailed observations of Centaurus A, the nearest galaxy harboring a supermassive black hole.

We can now offer our customers both carbon- and beryllium-doped InP HBT wafers for the next-generation of 40 Gb/s (OC-768) optical networks and power amplifiers for 3G wireless bandsets,” said Kao.

C-doped InP HBT epiwafers for 40 Gb/s

InP and GaAs epiwafer foundry Intelligent Epitaxy Technology Inc (Richardson, TX, USA) has launched MBE-grown carbon-doped InP HBT epiwafers (after supplying to strategic customers since March 2001).

“IntelliEPI has been working on 4" InP HBT epiwafers since the first half of 2000,” said president & CEO Dr Yong-Chung Kao. Device results on SHBT wafers have shown $f_T = 200$ GHz, $f_{\text{max}} = 200$ GHz, and resistivity uniformity of <0.5% across-wafer and wafer-to-wafer. Carbon-doping levels are up to 20 cm$^{-3}$ (“only achievable by MBE”).

Sales & Marketing Director Jim Fang says it has also been supplying Be-doped InP HBT wafers in large volume to key customers - SHBT wafers have consistently achieved $f_T = 150$ GHz and $f_{\text{max}} = 160$ GHz.

SiGe hits 56 Gb/s

At October’s GaAs IC Symposium in Baltimore, MD, USA IBM Corp said it had achieved sustainable line rates of 56 Gb/s using its production-level 0.18 μm 7HP SiGe process at its fab in Burlington, VT, USA. This shows that existing SiGe processes can build devices for OC-768 (40 Gb/s) networks, said researcher Modest Oprysko.

IBM sent four 14 Gb/s signals into a 4:1 multiplexer, which combined them into a 56 Gb/s feed, which was then used to test a demultiplexer.

The chips operated with a 3.3 V power supply at up to 1000C and consumed 360 mA.

IBM also discussed a SiGe electro-absorption modulator for OC-768 analog circuits, despite its low breakdown voltage at high frequencies.

Intel to use processor technology for RF and SiGe

In a late-October briefing Intel Corp (Santa Clara, CA, USA) said its "Process Technology Progression Model" strategy makes use of its microprocessors-oriented logic process as a baseline technology, not only for its processor designs but to accelerate development of other chip technologies. "We have internal developments in RF and SiGe," said Brian Harrison, vp of the Technology and Manufacturing Group.

Intel will develop 0.18 μm SiGe-based chips, to be made by Communicant.

In November Intel-backed US$1.5bn pure-play SiGe:C foundry fab start-up Communicant Semiconductor Technologies AG began laying foundations for its 200 mm fab in Frankfurt an der Oder, Germany.