Development of infrastructure for 3D TSV packaging technology at the facilities of Zelenograd Nanotechnology Center

SEMICON Russia, June 6, 2013
Session II: 3D Packaging and TSV Project in Russia: Overview and Opportunities
Speaker: Alexey Leontiev, Head of International Relations Department
2.5D Interposer 2010-2017 wafer forecasts

Source: Yole Development, January 2013 г.
Zelenograd Nanotechnology Center – potential infrastructure for 3D TSV technology

IC, SoC, MEMS and NEMS pilot manufacturing line (6” wafers, 600 w/month, capacity of 350 nm)

Chips packaging, testing and assembling line (100 000 pcs./month)

IC design software (capacity 65 nm)

Clean rooms, 1000 sq.m. class: 10 – 1000

Photomasks production line (current technology level 180 nm, transition to 90 nm)
designing VLSI for data processing, data storage, data transfer for NEMS/MEMS sensors

manufacturing NEMS and MEMS devices:

- NEMS magneto-resistive transducers on the basis of giant and anisotropic magnetoresistance effect
- NEMS piezo-resistive transducer (pressure sensor)
- NEMS thermo-resistive transducer (flow transmitter)
- auto base-emitter nanostructures
- NEMS and MEMS sensors for gyroscopes
- NEMS and MEMS sensors for accelerometers
- micro mirror matrixes on the basis of silicon bulk micromachining technology
- multifunctional console nanoprobes

assembling of intelligent sensors on the base of CMOS IC with NEMS and MEMS integration in integrated design

Competitive products
- Magnetic field sensors
- Temperature sensors and Gas flow sensors
- Liquid flowmeter
- Gas flow counter
- Micromechanical accelerometer
The development of quality management system, based on CALS principle up to standard ISO 9001, GOST ISO 9001-2008

Modern equipment, complex engineering infrastructure and well-developed network of business contacts with partners guarantees quality and reliability of our work.

ZNTC certification

Joint R&D project with Fraunhofer IZM ASSID

- Participants: IZM-ASSID, MAICOM, UNIR, ZNTC

- Development of an advanced interposer platform as carrier for heterogeneous system integration

- The project goal is to investigate material properties of TSV’s and Interconnects, which are the new vertical wiring features of 3D interposer technology:
  
  - perform the annealing for defined time frames with different (increased) temperatures steps
  
  - investigation of samples by cross section or FIB’s and related investigation methods (e.g. SEM, STEM).
Available equipment for Analytical works with FhG IZM ASSID

- JEOL JSM-6490 LV
- Scanning Auger Spectrometr PHI-670/680 xi
- SEM MILL 1060
- AFM Smart SPM AIST-NT
- Wyko NT 9300
- FLTP 5700
- DAGE XD 7600-NT
- Agilent D1500A
- Vacuum
- System for thermo-cycling CTS

Scheme of cooperation
Requirements for 3D TSV technology equipment with 200-300 mm wafers

1. Thickness of wafer in the bonding area – 35-50 µm.
2. Aspect ratios of TSV channels:
   • diameter of channel 50 µm, pitch -10³/sm²;
   • diameter of channel 10 µm, pitch – 10⁴/sm²;
   • diameter of channel 1,0 µm, pitch – 10⁵/sm².
3. Complex should include the following equipment:
   • chemical processing;
   • photolithography;
   • thinning, incl. formation of ring holder (Taico systems from Disco);
   • CMP, incl. formation of ring holder (supporting edge);
   • CVD and PE CVD of deposition of dielectric layers;
   • magnetron, gas-core and electrochemical deposition of conductive layers;
   • chemical and gas-core etching of dielectric and metal films;
   • bonding.
4. All equipment must work with initial thickness of wafers and with ring supporting edge holder.
## Set of equipment for 3D TSV

<table>
<thead>
<tr>
<th>Process/operation</th>
<th>Equipment</th>
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<tr>
<td>Si Bosh-etching for creating high AR channels</td>
<td>SPTS CPX Pegasus</td>
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<tr>
<td>Isolation layer defence</td>
<td>Ti-TiN Amat Endura</td>
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<tr>
<td>Underfill and PE CVD</td>
<td>STPS Novellus</td>
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<tr>
<td>Galvanic</td>
<td>labGalv TBS Amat</td>
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<td>Thinning</td>
<td>Disco DAG 810</td>
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<td>Dicing</td>
<td>DAD3350 Disco Corp</td>
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<tr>
<td>Chipping (flip-chip) with electrical soldering</td>
<td>PP5/2 PP5/4 Cefor Ingenierie</td>
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<tr>
<td>Wire bonding with thermo- and ultrasound soldering of leads of stacks</td>
<td>5300 B-DA, F&amp;K Delvotec GmbH</td>
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<td>Line of hermetisation</td>
<td>HPS 9206, Pyramid Engineering Systems Ltd.</td>
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<tr>
<td>X-ray digital system with tomography</td>
<td>XD7600NT DAGE Precision Industries Ltd.</td>
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<tr>
<td>Wafer probing</td>
<td>UF200A, TOKYO SEIMITSU CO., LTD</td>
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<tr>
<td>IC testing in 500MHz and up to 256 leads</td>
<td>UltraFlex, Teradyne Inc.</td>
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<tr>
<td>Two-side alignment and assembly for bonding</td>
<td>MA6/BA6</td>
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</table>
1/3 of equipment available for basic process flow

Available

- Input control of wafer
- Thinning
- Removing the outer edge
- Input control Interposer
- Installation of a ceramic body
- Making wire bonds
- Pressurization

To be purchased

- Wafer planarization
- Washing plates
- Mounting on a film carrier
- Laser cutting
- UV irradiation
- Dismantling of a film carrier
- Alignment and bonding the chip on Interposer, C2W
- Mounting on a film carrier
- Formation FC bump on Interposer
- Laser cutting
- Interposer alignment and bonding to the chip carrier, C2W
- Mounting on a film carrier
- Laser cutting
- UV irradiation
- Dismantling of a film carrier
Main Russian customers

- JSC "Concern" Aircraft Engineering ";
- FSUE "SPC Automation and Instrumentation";
- FSUE "STC" Atlas ";
- JSC "Russian Space Systems";
- Federal State Unitary Enterprise "Research Institute" C
- OJSC Concern PVO "Almaz-Antey";
- FSUE "SPE" Radio ";
- JSC "NPP" Sparkle Factory ";
- JSC "Concern" Vega ";
- Of "USM" Magnetron ";
- JSC "RSIME";
- JSC "NITSEVT";
- FSUE "RNIIRS";
Ready for cooperation

We look forward to hearing from you!

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