Enabling the Future of 3D TSV

Frédéric Raynal, PhD
Chief Technical Officer, aveni

European 3D Summit
18–20 January, 2016

aveni Company Overview – Who Are We?

- We are the FUTURE: aveni **[àv(ə)ni]** derived from **avenir** (*nm*) → future
- aveni is a spin-off from CEA (French Alternative Energies and Atomic Energy Commission)
- aveni took over the legacy of Alchimer (an R&D company), and transformed it into a success story
- aveni is headquartered in Massy, France, with 20 employees
- aveni Mission Statement:

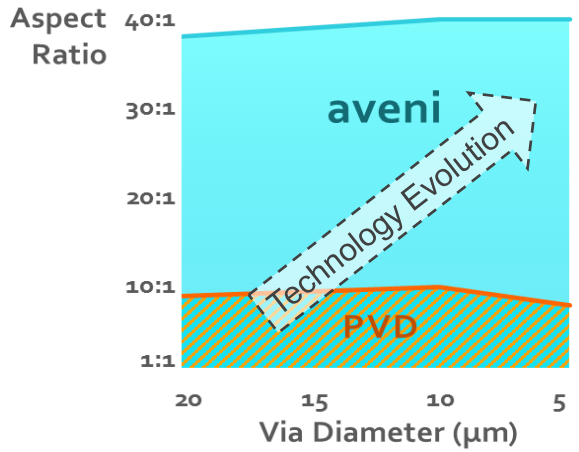
Offer superior metallization solutions to the semiconductor and related industries, with compelling extendibility and cost advantages

  - 3D TSV, TGV, MEMS, redistribution layer (RDL), Damascene, et al.

Current Landscape for Conventional TSV Metallization Technology is Limited

- Wire bonding (Cu, Au) between ICs
- Technology is transitioning to 3D TSV for high-end applications
  - Enables smaller, higher-density devices
- Metallized with PVD films (dry processes)
  - Challenging to metallize beyond ~ 8:1 aspect ratio
- Cost factors also limit fundamental TSV design rules
  - Poor step coverage, low throughput, and capital-intensive processing

Metallization Process Window

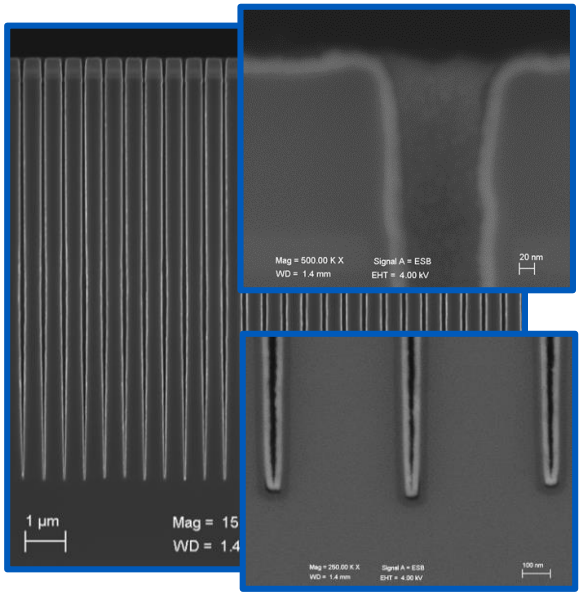


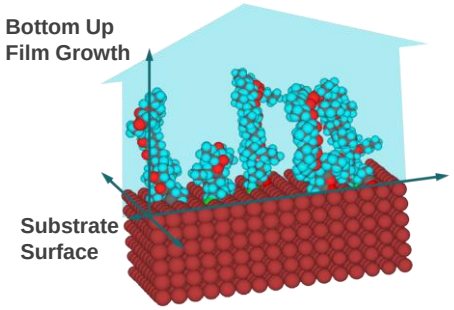
Wire bonding

aveni's Disruptive Technology Enables Future Design Rules

- Electrografting (eG™) and Chemicalgrafting (cG™)
  - Patented wet chemistry deposition techniques
  - Films grow and bind to substrate with superior quality
    - Conformal films with 100% step coverage
    - "Bottom up" void-free filling
  - Metallizes narrow structures, up to 40:1
- aveni's technology makes 3D TSV a reality
  - Next generation process capability at competitive cost
  - Eliminates processing steps (barrier and Cu seed layers)
- Over 300 patents filed, from 36 patent families

100% step coverage at 40:1 AR





aveni Target Markets and Business Model Differentiation

- aveni formulates **complex chemistries** and **processes** to serve the 3D TSV/MEMS, 3D stacked memory, and Cu damascene markets
  - Our customers manufacture devices using TSVs
  - Our processes are compatible with standard installed-base ECD equipment
  - Our products are manufactured and delivered in collaboration with Air Liquide
- We serve foundries and Integrated Device Manufacturers (IDMs)

aveni Key Differentiator:

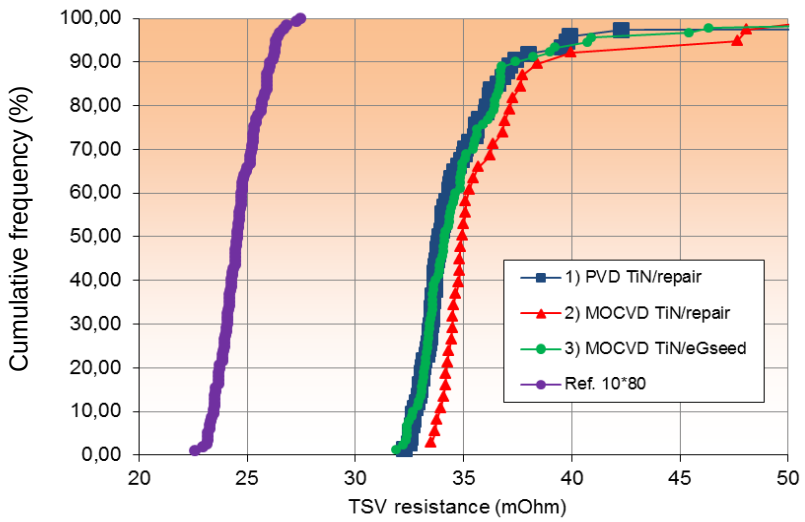
We offer expertise in direct chemistry formulation,

PLUS the knowhow to implement yield-enhancing processes

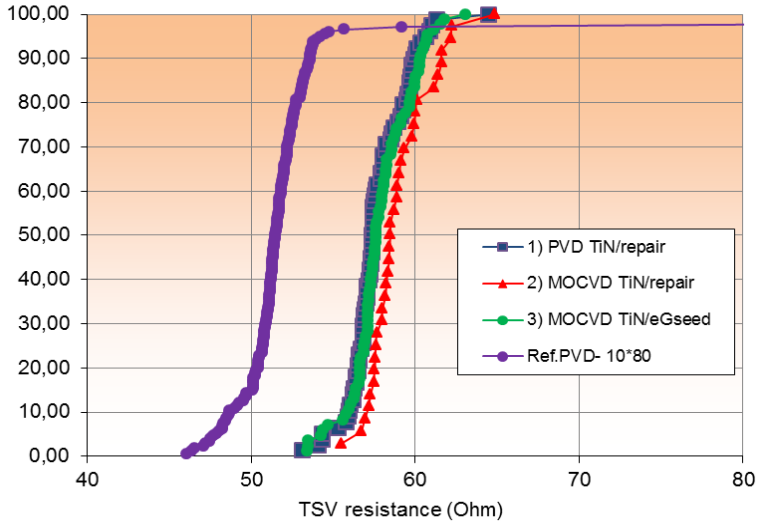
Excellent Electrical Results With aveni Seed

INTEGRATION

Electrical results



10 x 100 µm - Kelvin TSV



10 x 100 µm - 754 TSV daisy chain

- Excellent yield whatever metallization conditions
- Sharp distribution
- No clear difference between the splits
- Same distribution as 10x80 µm full PVD reference, difference is due to TSV height

Why Are We Here Today? To Spread The Word…

- To show what's possible for TSV technology design
- Beyond 8:1 aspect ratio is not just a dream; it is a reality we have already demonstrated
- Our technology has been validated and accepted
  - We have raised $13.5M funding in Q3'15
    - Semiconductor IDM, ALIAD, Panasonic, et al.
  - We have achieved process of record at Teledyne DALSA and Leti

aveni's highly conformal Cu seed inside TSV

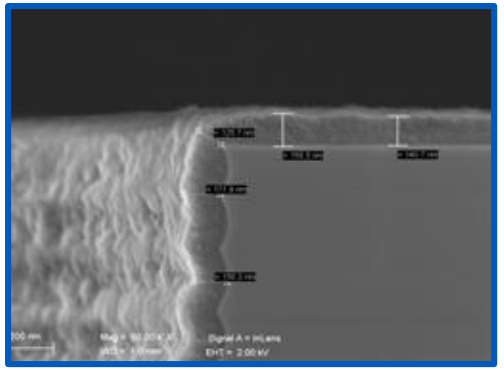


Image courtesy of Teledyne DALSA

aveni enables the future of TSV

THANK YOU!

For more information, contact
Christophe Fitamant
c.fitamant@aveni.com
www.aveni.com