OVERVIEW OF ADVANCED MATERIAL DEPOSITION CAPABILITIES
300mm & 200mm Si components Platforms
- ~270@200mm equipments
- ~105@300mm equipments
- 5600 square meters Cleanroom - ISO3-5
- 24/7 operations

200mm MEMS Platform
- ~130@200 mm equipments
- 2200 square meters - ISO 4-5
- 24/7 operations

Substrates <200 mm, III-V and II-VI Platform
- ~230 @ various diameter equipments
- 1000+1000 square meters - ISO 4-5
- 1shift/day

Nano-CHARACTERIZATION Platform
- ~ 40 huge equipments
- 2200 square meters
- 8 centers of competences
OUR COLLABORATION OFFER

- New products & applications
  - Collaboration thru LETI’s Silicon Product Divisions (DCOS, DOPT, DTBS)

- Mature Processes & Technologies
  - Wafer service thru LETI 3S (Silicon Specialities Solutions)
  - IP licensing
  - Technology Transfer

- New Materials & Process Development
  - Collaborative bilateral research on specific project
  - Common laboratories
  - Affiliation program

- New Equipement Engineering
  - Specific Joint Development Program

A full range of business models to meet our partner’s needs
• Our Motto:
Developing Advanced Materials Solutions for Industrial Applications
- 100 permanent positions
- 10 PhD students
- 7X24 hrs Shift time

Field of applications
- Microelectronics
- Photonics
- Sensors

PVD, CVD, ECD
- 40 Tools
- > 100 process chambers
- 200 and 300 mm
3 ACTIVITY TYPOLOGIES

Daily Operations
- Known Process
- Recurrent Batches
- Higher Level of Maturity
- Challenged in term of delay (typically <1 shift)

Engineering Developments
- Process tuning on known basis
- « Longer » developments (typically < week)
- Directly related to the programs needs
- Challenged in term of delay

Optical Filters

Longer term R&D
- New Material Developments
- New Deposition Technique
- New Material Functionalities
- In collaboration with Academics and Tool Suppliers
• **Our Motto:**
  « From Material to Device » : fast Proof Of Concept demonstration mainly for Photonic Applications.

• **Our Skills:**
  Crystal growth & Thin Film epitaxy
  Technology & processes on Non « CMOS standard » substrates & materials
EXAMPLE 1/6
Advanced Contact Technologies for Electronics and Photonics

• From Surface Preparation to Contact Plug and Integration

Impact of preclean on surface properties

Quasi in-situ XPS

AFM

InP surfaces

Study of solid-state reaction

Ni / GeSn system

Contact Plug Development

W Liner and W Filling

Integration of contacts

III-V / Si Lasers
EXAMPLE 2/6
Phase Change Memories

Cosputtering capability for composition fine-tuning

Multicathode chamber

Industrial pDC GST chamber

PCM full stack deposition:

Quasi in-situ metrology connectivity via Single wafer vacuum carrier (XPS, Raman, Ellipsometry w/o air break)

Si-PCM full stack deposition:

Phases Change Memories

Top electrode

Surface preparation

Ti/TiN

Multi-layer deposition and ultra thin film control

Memory cell on 300mm MAD300 test vehicle
Applications

- RGB filter on top of photosites matrix
  - Colored picture (Bayer Matrix)

- IRCUT / IRPB filters defined under RGB filter
  - IRCUT: suppress RGB filter rejection in IR
  - IRPB: optimization of transmittance in IR

AMAT PRODUCER GT1

In Operando metrology

EXAMPLE 3/6
Filters for CMOS Image Sensors
Example 4/6
Interconnects for 3D integrations

- **TSV**
  - Barrier and seed deposition: Versalis (MOCVD TiN, iPVD Cu)
  - eGseed (Direct on Barrier / seed repair): Raider ECD4- aveni chemistry
  - TSV filling: Raider ECD4- Dow IL9200
  - Anneal: Oven Cu1-2

- **DAMASCENE**
  - Barrier & seed layer: Endura 300B (iPVD TaN, Cu)
  - ECD filling: Raider ECD4- NP52000
  - Anneal: Raider ECD1

- **RDL, μbumps, μpillars**
  - Ti, Cu undelayer: Versalis
  - ECD metal deposition: Raider ECD3 (Cu, Ni, SnAg, Au)

- **Cobalt ECD**
  - advanced “zip filing” process developed with aveni

---

Example 4/6
Interconnects for 3D integrations

- **TSV**
  - Barrier and seed deposition: Versalis (MOCVD TiN, iPVD Cu)
  - eGseed (Direct on Barrier / seed repair): Raider ECD4- aveni chemistry
  - TSV filling: Raider ECD4- Dow IL9200
  - Anneal: Oven Cu1-2

- **DAMASCENE**
  - Barrier & seed layer: Endura 300B (iPVD TaN, Cu)
  - ECD filling: Raider ECD4- NP52000
  - Anneal: Raider ECD1

- **RDL, μbumps, μpillars**
  - Ti, Cu undelayer: Versalis
  - ECD metal deposition: Raider ECD3 (Cu, Ni, SnAg, Au)

- **Cobalt ECD**
  - advanced “zip filing” process developed with aveni

---

Example 4/6
Interconnects for 3D integrations

- **TSV**
  - Barrier and seed deposition: Versalis (MOCVD TiN, iPVD Cu)
  - eGseed (Direct on Barrier / seed repair): Raider ECD4- aveni chemistry
  - TSV filling: Raider ECD4- Dow IL9200
  - Anneal: Oven Cu1-2

- **DAMASCENE**
  - Barrier & seed layer: Endura 300B (iPVD TaN, Cu)
  - ECD filling: Raider ECD4- NP52000
  - Anneal: Raider ECD1

- **RDL, μbumps, μpillars**
  - Ti, Cu undelayer: Versalis
  - ECD metal deposition: Raider ECD3 (Cu, Ni, SnAg, Au)

- **Cobalt ECD**
  - advanced “zip filing” process developed with aveni

---

Example 4/6
Interconnects for 3D integrations

- **TSV**
  - Barrier and seed deposition: Versalis (MOCVD TiN, iPVD Cu)
  - eGseed (Direct on Barrier / seed repair): Raider ECD4- aveni chemistry
  - TSV filling: Raider ECD4- Dow IL9200
  - Anneal: Oven Cu1-2

- **DAMASCENE**
  - Barrier & seed layer: Endura 300B (iPVD TaN, Cu)
  - ECD filling: Raider ECD4- NP52000
  - Anneal: Raider ECD1

- **RDL, μbumps, μpillars**
  - Ti, Cu undelayer: Versalis
  - ECD metal deposition: Raider ECD3 (Cu, Ni, SnAg, Au)

- **Cobalt ECD**
  - advanced “zip filing” process developed with aveni

---
Piezoelectric materials

Expertise in piezo material

**PZT (Pb(Zr,Ti)O3)**
- Sol gel deposition
- MEMS actuators
- High K, High piezo coef

**AIN**
- Sputtering deposition
- NEMS sensors, Acoustic Wave Devices

**LiNbO3**
- AIN:Sc (K,Na) NbO3
- Pulsed Laser Deposition
  - Starting 2020

EXAMPLE 5/6
From proof of concepts

To Léti 12” demos

Patent process

And Joint Developments with Industrial Equipment Suppliers

- 3 MoS₂ monolayers on 12” substrates
- ~50nm domains size
PEOPLE
- ~ 100
- 24 hours shift organisation

CAPABILITIES
- ~ 100
- [PVD CVD ALD ECD]
- tool chambers
- Industrial config or Dev Tools

OUR GOAL
- speed up your innovations in material sciences
- and bringing them to industry
THANK YOU FOR YOUR ATTENTION

Contact : ANDRE Bernard
Head of Advanced Material Deposition Department

Next related talks :
- Advanced Metal Contact : Philippe Rodriguez
- 2D materials : Cécile Moulin
- Piezo materials : Guillaume Rodriguez
- AVENI solutions for 3D : Céline Doussot
- GaN Material : Bérangère Hyot
- Materials for Topologic Isolation : Philippe Ballet