



Comprehensive Flexible Electronics Capabilities that bridge the high risk, resource intensive gap between innovation and product development in an information-secure environment.

Sponsor Services:

- Fee-for-Service
- Integrated Circuit (IC) Design, Development and Fabrication of Inorganic and Organic Thin Film Transistor (TFT) Arrays
- Design for Manufacturability with High Yield and Optimal Circuit Performance
- Early Stage Prototyping and Low-Volume Production (e.g., 1000 units/yr.)

Facility: Located in ASU Research Park, Tempe, Arizona, the FDC is a world-class facility with 43,500 sq. ft. of Class 10/1,000 Fabrication Clean Rooms and 22,000 sq. ft. of Class 10,000 wet/dry laboratories with the following Pilot Line Fabrication Capabilities:

1. 6-Inch (150 mm) Wafer-scale Pilot Line for Research and Development (3 micron feature size (L/S))
2. GEN II (370mm x 470 mm) Pilot Line for Low Volume Production (3 micron feature size (L/S))

Both Pilot Lines are linked to a Manufacturing Execution System (MES) for Efficient Lot Management and Statistical Process Control (SPC)

Electronic Design Automation (EDA) for IC Design, Modeling and Simulation:

- Professional Suite of Flexible / Large Area Microelectronics Design Tools:
 - Circuit Simulation
 - Design Rule Checking (DRC)
 - Layer Verification (LVS)
 - Layout
 - AutoPlace and Route with *Standard Cell Library Development Capability*
- State-of-the-Art a-Si:H Transistor Models including V_T Shift
- Extensive Suite of Digital and Analog Circuit Testing Equipment

Fabrication Processes:

1. **Substrate Materials:** Si, Glass, PEN, Polyimide (PI), Stainless Steel (SS)
2. **Photolithography:** Automated Distortion Compensation for Plastic Substrate Materials (PEN, PI)
3. **Deposition:**
 - Physical (sputter) Vapor Deposition (PVD): Al, Mo, Ta, ITO, (Cr, 6-in. line only)
 - Plasma-Enhanced Chemical Vapor Deposition (PECVD): a-Si, n⁺a-Si, SiN
4. **Etch:** Dry and Wet
5. **Solution Processing:** Spin-on Glass (SOG), PI, Benzocyclobutene (BCB); (6-in. line only)
6. **Analytical Techniques and Materials Testing (*GEN II Compatible):**
 - Ellipsometry* for film thickness and optical properties
 - White Light Interferometry for optical surface profile
 - X-Ray Fluorescence (XRF) for film thickness
 - Step Height Profilometer
 - Film Stress*
 - Four Point Probe
 - Fourier Transform Infrared Spectrophotometer (FTIR)
 - Wafer Flatness: Bow and Warp
 - Critical Dimension (CD) Measurement*



- Scanning Electron Microscopy (SEM) for surface morphology
- Atomic Force Microscopy (AFM) with tapping mode and contact mode for surface topography, TUNA (Tunneling AFM) and STM (scanning tunneling microscopy) for conductivity measurements of materials, and Nanoman with nanoindentation, nanolithography and nanomanipulation (carbon nanotubes) and tapping mode in liquid (biomaterials)
- Field Emission Scanning Electron Microscopy (FESEM) – Tempe Campus

Electrical Testing:

- Automated transistor and PCM testing
- Automated TFT array test

Display Characterization and Testing:

- Eldim EzLite

Flexible and Organic Electronics Development Laboratory (FOEDL): Prof. Ghassan E. Jabbour, Director

- Photomask Aligner (6-in., 25 substrate cassette)
- Multi-chamber (Train) Sputter Deposition
- E-beam metal deposition
- 8-in. Spin Coater (Controlled Atmosphere)
- Blade Coater
- Inkjet Printers: Dimatix Piezoelectric Inkjet , Litrex (4-cartridges), HP and Cannon heat (bubble) inkjet technology
- Reactive Ion Etcher (RIE): oxide or nitride
- OLED Materials Optimization: Small Molecule, Phosphorescent, Fluorescent and Macromolecules
- Encapsulation: liquid and vacuum-based approaches
- OTFT Materials Characterization:
 - Bottom and Top Contact Devices
 - Transistor materials: Small Molecules, Conjugated Polymers, Hybrid Inorganic/Organic structures, Molecular nano-tube based coatings and transparent inorganic-based TFTs.
 - Gate Insulators
 - + Organic Insulators: PMMA, PVP, photoresist, various resins
 - + Inorganic Insulators: SiO₂, Al₂O₃, TiO₂
 - Contacts
 - + Organic: PEDOT:PSS, PANI, others
 - + Metals: Gold, Silver, Aluminum, thers

Related ASU Research Programs and Capabilities:

- Center for Solid State Electronics Research (CSSER): Nanostructures: Molecular Beam Epitaxy and Optoelectronics; Materials and Process Fundamentals; Low Power Electronics, Bio and Molecular Electronics; MEMS and Nano-fluidics; High-K Dielectrics and Nano-magnetics
- WINTech: Wireless Integrated Nanotechnologies, incl. communications components, telemetry, antennas
- BioDesign Institute at Arizona State University:
 - + Center for Bioelectronics and Biosensors
 - + Center for Applied Nano-Biosciences
- Photonics: IR Displays
- MEMS: Capacitive Sensors and Accelerometers
- Center for Advanced Photovoltaics (pending)

