



UTAH NANO FAB Tool List



Nano-scale Imaging & Surface Analysis

(co-located MRSEC shared facilities)

- JEOL JEM-2800 S/TEM with ultrafast EDS (3D tomo) Protochips liq & gas phase ETEM / electrochemistry
- FEI Helios Nanolab 650i hi-res dbFIB, Nabity EBL Pt, W, C dep; XeF₂, I₂, H₂O enhanced etch, EDS, EBSD
- FEI Quanta 600 FE-ESEM w/ EDS, EBSD, particle ID, MAPS
- Kratos AxisUltra imaging XPS / Auger / ISS / UPS
- EDAX Eagle III Microspot XRF (μprobe & mapping)
- JEOL 5910 LV-SEM (quick-look inspection SEM)
- Bruker ICON-PT AFM: PF-QNM, wet cell, MFM, KPFM
- Woollam V-VASE spectroscopic ellipsometer
- ZYGO NewView 5032 optical profilometer
- Micro fiducial laser cutter for correlative multiscale microscopy: 355, 532, 1064 nm; 1.2-15mJ
- Vertex 220 microVu Digital Comparator
- SEM/TEM prep tool suite, manual and ion polishing
- Hysitron TI Premier Nanoindenter system

Cleanroom

DESIGN & SIMULATION SOFTWARE

- L-Edit, Cadence, AutoCAD
- Link-CAD DXF/GDSII/CIF/PG/EM conversion tools
- SASS JMP statistical design of experiments (CADE)
- ANSYS & COMSOL finite element analysis

LITHOGRAPHY (C-100) Pattern Generation & Transfer

- Heidelberg μPG 101 Laser Pattern Generator (x2) 0.9μm, 2.5μm write heads, gray scale patterning
- Nanofrazor 20-50nm nanolitho tool (pending 8/17)
- EVG EV-420, Suss MA1006 front & backside mask aligner
- OAI Models 200 & 810 (with BSA) contact aligners
- Spinners, ovens, hot plates, hoods, SRDs, . . .
- LOR 7B, AZ 9620, Shipley 1813, nLOF 2020
- YES HMDS vapor prime vacuum ovens

THIN FILM DEPOSITION (C-1000) Sputtering:

- TMV SS-40C: 8 dedicated cathodes, dual cryo-pumped
 - Denton Discovery 18: 3 user config 3" cathodes, RF/DC
 - Denton 635LL: 4-cat, RGA, OES-feedback reactive sputter
- Metals/Alloys: Ag, Al, Al/Si, Au, C, Chromel, Co, Cr, Cu, Cu/Ag, Ir, Ge, Fe, Ni, NiCr, NiCrFe, Nb, Pd, Pt, Si (p-type), Ta, Ti, TiW, V, W, Cr₂Si, Zr, Hf*

Oxides / Ceramics: Al₂O₃, SiO₂, ITO, BN, CeSm(ox), LaSrFe(ox), NaMnO₃, NdMgO, SiC, Si₃N₄, TaO₂, TiO₂, YNiZrO, YSZ, ZnO, MgO

Evaporation: Al, Ag, Au, Au/Ge, Cr, Cu, In, Mg, Mo, NiCr, Ni, Ta, Ti

- Denton e-beam DV-SJ/20C with 4 hearths, user config
- CHA 600 e-beam (Al, Mg)

PECVD

- Oxford Plasmalab 80+: α-Si, Si₃N₄, SiON_x, SiO₂

CVD

- SCS PDS 2010 Parylene-C

ALD

- Cambridge Fiji F200 w/ thermal & plasma dep modes, H₂O plasma (Pt, HfO₂, ZnO, Al₂O₃, SiO₂, TiO₂, MgO, ZrO₂, AlN)

FURNACES and DIFFUSION (C-1000) LPCVD

- Expertech TEOS / LTO / PSG / low-stress Si₃N₄, α & phos-polySi

Atmospheric and Rapid Annealing

- Blue-M box furnace with N₂ purge
- ProTemp wet/dry oxidation with DCE
- Allwin 610 RTP/RTA with O₂, N₂, Ar, H₂ forming gas, 200-1250C
- Tystar MiniTitan 4600 clean oxidation (pending installation)

ETCH (C-1000)

RIE and DRIE

- STS Aspect ICP DRIE: time-multiplex Si etch (anti-footing)
- Oxford Plasmalab 100+ ICP time-multiplex & cryo DRIE SF₆, CF₄, CHF₃, O₂, Ar, N₂
- Oxford Plasmalab 80+ multipurpose (SF₆, CF₄, O₂, Ar)
- Technics PEII H₂O, O₂ descum & resist strip
- Xactix Xetch XeF₂ silicon isotropic etch
- Plasmatherm 790 (2X, oxide and metal etch Cl₂, BCl₃ pending)

Wet Chemical

- Bold & WAFAB wet benches (x6) acids, bases, organics
- Au etch station

MICROMACHINING

- JPSA Micromachining system Ar/F₂ 193 nm
- Reel-Tech LM4000 Nd-YAG (1064nm) laser micromachining
- Custom KOH bulk Si etch station
- Cu & Ni electroplating station

BACKEND PROCESSES & PACKAGING

- Strasbaugh 6EC 100 mm CMP (Si, SiO₂ polishing & planarizing)
- EVG 520IS wafer bonder (hot embossing, thermal & anodic)
- Disco DAD 641 & Disco 3220 dicing saws (std or UV tape)
- MEI wedge wirebonder with Au and Al wire
- TUI 9101 wire bond pull tester

MESO-SCALE PROTOTYPING

- LaserStar 1900 micro laser welder (1064nm, 150J)
- Viteris Technologies Precision Microwire EDM
- CO₂ Laser (dual laser cartridge, 25W + 75W, 1090nm)



UTAH NANOFAB Tool List



USTAR
UTAH'S TECHNOLOGY CATALYST



CLEAN (class 10k) MICROFLUIDICS

- ◆ Omnicure 1000 UV curing (320-500nm)
- ◆ lamination press
- ◆ Corona discharge UV/O₃ plasma treatment
- ◆ Fume hood with CEE Spinner Vacuum Oven Suite

CLEANROOM (C-1000) METROLOGY

- ◆ Keyence VHX-5000 3D microscope
- ◆ LEO 440 SEM
- ◆ n&k NKT 1500 thin film analyzer
- ◆ Nanometrics NanoSpec 3000 film thickness
- ◆ Magnetron Instruments 4-point probe
- ◆ Polyvar Met with DIC + many optical microscopes
- ◆ Nikon V12A optical comparator
- ◆ Tencor P-10 and P-20 stylus profilometers
- ◆ Tencor Flexus 2320 film stress analyzer

ELECTRICAL / MAGNETIC TESTING

- ◆ Verigy 9300 SOC IC tester
- ◆ Microsense vibrating sample magnetometer (EZ-7 VSM)
- ◆ Keysight 404A Mixed Signal O-scope
- ◆ Keysight E5061B Network Analyzer
- ◆ Keithley 4200 parameter analyzer with 4 SMUs
- ◆ Micromanipulator light-tight probe station

STAFF SERVICES

- ◆ Equipment Installation, Diagnostics, and Repair
 - Alcatel ASM 180TD dry-pumped leak detector
- ◆ Professional Technical Support
 - Design of Experiments (DOE)
 - R&D Process Development
- ◆ Thin Film Deposition and Patterning
- ◆ Center for Engineering Innovation www.cei.utah.edu
 - Engineering design services
 - (Bio)MEMS design and fabrication
 - Advanced package development

AFFILIATED CHARACTERIZATION LABS

- ◆ SMBB Co-located HSC Core Facility www.cores.utah.edu/
 - JEM 1400 TEM (120 keV)
 - FEI Technai T-12 TEM (120 keV), T-20 (200 keV cryo)
 - Olympus FV-1000 Scanning laser confocal sources: 405, 457, 488, 514, 568, 633, 748nm
- ◆ Dixon Laser Institute www.physics.utah.edu/laser/
 - Witec Alpha 300 SNOM, Raman, and Confocal
 - FEI NovaNano 630 FE-SEM w/ EDS, CL and Nabity EBL
- ◆ X-ray CT Lab – Michael Czabaj m.czabaj@utah.edu
 - Varian BIR/150/130; GE eXplore Locus SP
- ◆ Fast-capture camera o.kingstedt@utah.edu
 - +10M fps Shimadzu Hypervision HPVX2 camera

- ◆ Nanomaterials Lab <http://nanomaterials.utah.edu>
 - Hitachi S-4800 HR-SEM / Oxford EDS (nuclear materials)
 - Micrometrics ASAP 2020 Surface Area (BET) Porosity
 - Shimadzu GCMS-QP2010; UFLC HPLC; UV-3600 UV-Vis-NIR
 - Benchtop powder XRD
- ◆ BYU: www.chem.byu.edu/faculty/matthew-r-linford/
 - TOF-SIMS IV
- ◆ Materials Science <http://characterizationlab.mse.utah.edu>
 - Philips X'Pert XRD (also DSC, dilatometer)
 - Hitachi S3000-N SEM w/ EDS & EBSD
 - FT-IR (Varian 3100) & PE Lambda 950 UV/VIS
 - Volatile, non-toxic deposition (ebeam and sputt)
- ◆ College of Earth Sciences (Geology & Metallurgy)
 - QEMScan 4300 (erich.petersen@utah.edu)
 - WDS microprobe (<http://probelab.utah.edu>)
 - ICP-MS (diego.fernandez@utah.edu)
 - Bruker D8 thin film XRD s.guruswamy@utah.edu
- ◆ Energy and Geosciences Institute (<http://egi.utah.edu>)
 - QEMScan EVO 50
 - XRD mineral quantitation
 - Wet laboratories (GeoChem Lab)
- ◆ Chemistry Department www.chem.utah.edu/facilities/
 - NMR: Unity-300, Inova-400, and VXR-500
 - Single Xyl XRD; MS: TOF, Quad GC, UPLC, FTIR
 - UV-VIS-NIR, Polarimeter, scintillation, lumi, fluor

MRSEC AFFILIATED LABS

nanofab.utah.edu/index/about-us/affiliatedlabs

- ◆ Organic spintronics deposition system
- ◆ Sagnac Interferometer
- ◆ Magnetic Resonance X-band cw-EPR, ENDOR, ELDOR
- ◆ (3+3)-Pass Tandem Fabry-Perot Interferometer
- ◆ THz Time-Domain Spectrometer
- ◆ UV Time-Resolved Spectroscopy

AFFILIATED PROTOTYPE MANUFACTURING LABS

- ◆ Mechanical Engineering Shops www.mech.utah.edu
 - 3D printing / rapid prototyping
 - Waterjet machining
 - All traditional machine shop tools
- ◆ Interference Lithography photonics.ece.utah.edu
- ◆ Center for Biomedical Microfluidics www.mems.utah.edu
 - PDMS and soft lithography
 - CO₂ laser micromachining
 - Knife plotter
- ◆ BioInnovationsGateway (BIG) bioinnovationsgateway.org
- ◆ Center for Medical Innovation <http://healthsciences.utah.edu/center-for-medical-innovation/>
- ◆ USTAR North Innovation Center <https://ustar.org/find-us-statewide/ustar-innovation-center>