

# Nano Infrastructure equipment list on Technion Campus (May 2010)

<b>Faculty of Electrical Engineering</b>  •The Zisapel Nanoelectronics Center (MNFU)	<b>Faculty of Materials Engineering</b>  •Electron Microscopy Center	<b>Faculty of Chemical Engineering</b>  •Cryo-Electron Microscopy Center (Soft Matter)	<b>Solid State Institute</b>  •Surface Characterization Center
<b>Faculties of Chemical Engineering Biotechnology and Food Engineering</b>  •X-Ray and Particle Characterization Facilities	<b>Faculty of Biology</b>  •Infrastructure Center for Life Sciences	<b>Computer Center</b>  •Center for Computational Nanoscience and Nanotechnology	<b>Faculty of Bio-Medical Eng.</b>  •Biomechanics and Tissue Engineering Center

# Faculty of Electrical Engineering

## The Zisapel Nanoelectronics Center

### MNFU - Micro and Nanofabrication Unit

- Nanospec AFT 2100 NANOMETRICS
  - The Nanospec/AFT is a computerized film thickness measurement system
- Four Point Probe FPP 5000 VEECO
  - The four point probe is an instrument to measure resistive properties
- ALPHA-STEP 500, Surface profiler, TENCOR
  - The Alpha-Step 500 is a microprocessor - based surface profiler used for making accurate measurements on vertical features ranging in height from less than 50 angstroms to 300 micrometers
- Ellipsometers: GAERTNER 116C; RUDOLPH AUTO II
  - The Gaertner Scientific Corporation L116C is a single wavelength variable angle ellipsometer using 632.8 nm line of a He:Ne laser for measuring film thickness and refractive index.
- Spectroscopic Ellipsometer SOPRA
  - Spectroscopic ellipsometer – spectral range 0.23um-2um. Variable angel of incidence. Software to fit measurements to model.
- Atomic Force Microscope DI 3000
  - Atomic Force Microscope provides the ability to image the surface topography and roughness of conducting and dielectric films as well as adsorbed molecules and nanoparticles

# Faculty of Electrical Engineering

## The Zisapel Nanoelectronics Center

### MNFU - Micro and Nanofabrication Unit

- ICP deep RIE Plasma Therm Versaline
  - The Plasma-Therm ICP reactive ion etcher has a load-locked chamber and is used for fluorine-based etching of silicon, silicone oxide and nitride
- ICP etcher Plasma Therm Shuttleline
  - The Plasma-Therm ICP reactive ion etcher has a load-locked chamber and is used for chlorine-based etching of compound semiconductors
- GCA AUTOstep 200 stepper 5X
  - GCA stepper is a 5X0.35NA stepper with environmental control.
- E-beam writing system RAITH E-line
  - The RAITH E-Line is an electron beam lithography system designed for R&D
- CV plotter, MDC
  - The MDC C-V plotter is a current -voltage measurement system used to analyze the properties of high quality semiconductor and oxide materials
- I-V Probe Station with 4155C SPA, AGILENT, MICROTECH
  - The system is dedicated to probe elementary components such as transistors or capacitors. The sliding stage provides 100 mm travel in X and Y, and the working position secured by vacuum

# Faculty of Electrical Engineering

## The Zisapel Nanoelectronics Center

### MNFU - Micro and Nanofabrication Unit

- PECVD (Plasma Enhanced CVD), UNAXIS
  - The PlasmaTherm -790 PECVD system is used to deposit dielectric films such as silicon dioxide, silicon nitride or SiOxNy
- RIE (Reactive ion etching) system, UNAXIS
  - The PlasmaTherm -790 RIE system is used to etch /strip dielectric and organic films such as silicon dioxide, silicon nitride or SiOxNy, polysilicon, silicon, polyimide, photoresists and etc
- ECR Etcher, UNAXIS
  - The Plasma-Therm 770 ECR reactive ion etcher has a load-locked chamber and is used for chlorine-based etching of compound semiconductors such as GaAs, GaN, InP and related materials
- BTU, 2-Stack, 8-tubes, silicon furnace
  - The BTU furnace are used for oxidizing silicon, annealing surface damage, alloying metal and driving dopants into substrates for junction formation
- JIPELEC, Rapid Thermal Processor
  - The Jipelec JetFirst RTP can be used for annealing silicon and III-V wafers, for rapid thermal oxidation and contact alloying processes
- HITACHI 4700-FE, SEM
  - The Hitachi S 4700 High Resolution Scanning Electron Microscope is a general purpose, 30 kV, diffusion pumped, cold field emission electron gun based SEM. Fully digital imaging, image processing and archiving system give exceptional performance on large and small specimens
- AXIS HF-8, Plasma etch Descum system
  - The AXIS HF-8 RIE system is used to etch /strip organic films such as polyimide, photoresists and etc
- Wet Benches
  - Capability of photoresist coating and developing. Cleaning and wet etching, for processing silicon and compound semiconductors

# Faculty of Electrical Engineering

## The Zisapel Nanoelectronics Center

### MNFU - Micro and Nanofabrication Unit

- MJB3 Contact Mask Aligner, KARL SUSS
  - The Karl Suss MJB3 exposure system is an optical contact mask aligner which aligns and transfer patterns from a quartz or glass mask to a photoresist coated wafer by exposing it to UV light 365 nm wavelength
- MA6 Contact Mask aligner, BSA system UV 400, Karl Suss
  - The Karl Suss MA-6 mask aligner is an optical system to align and transfer the pattern from the mask to the photoresist layer spinned onto a wafer
- Ion Milling, MILLATRON
  - The Commonwealth Scientific Corporation Ion Mill system uses an energetic beam of argon atoms to physically remove (etch) material from the surface of a substrate
- JEOL JSM 6400 electron beam lithography system
  - The JEOL JSM-6400 is an electron beam lithography system designed for R&D of III-V transistors as well as process development and prototype engineering for optical elements, X-ray masks, and Silicon devices
- E-beam evaporator AIRCO TEMESCAL BJD 1800
  - The e-beam BJD 1800 evaporator is 18" diameter water cooled process chamber with VV-400 viewport
- E-beam evaporator AIRCO TEMESCAL FC-1800
  - The e-beam FC-1800 evaporator is 18" diameter water cooled process chamber with VV-400 viewport
- E-Beam Evaporator, Custom made, VST
  - The e-beam VST evaporator is a 18" diameter process chamber with front viewport and accommodate samples up to 2.5 inch.
- PERKIN ELMER, Sputtering tool
  - The Perkin Elmer 2400 Sputtering tool is a general purpose RF sputter system

List is yet to be completed

# Faculty of Chemical Engineering

## Cryo-Electron Microscopy Center

### Electron Microscopy of Soft Matter

- Zeiss Ultra Plus High-Resolution Cryo-Scanning Electron Microscope (HR-Cryo-SEM)
  - Complete with specimen preparation equipment based on s Bal-Tec BAF-060 system.
- Philips CM120 cryo-dedicated Cryo-Transmission Electron Microscope
- FEI T12 G2 cryo-dedicated Cryo-Transmission Electron Microscope
  - Both TEMs have all the needed specimen preparation equipment, including a home-built controlled environment vitrification system (CEVS), an FEI Vitrobot, and the Bal-Tec BAF-060 system for freeze-fracture-replication.
- Olympus BH-2 light microscope
  - Equipped with 10-100x objective lenses, an Optronics LE-Digital camera, crossed-polarizers, phase-contrast and Nomarski optics. Hot-stage and cold-stage are also available.
- Rheometric Scientific ARES Rheometer
  - Equipped with a 100FRTN1 transducer and cone-and-plate, parallel-plates and Couette measuring devices

### Biotechnology and Food

**Engineering Building** (adjacent to Chem. Eng.)

- Leica UC6 Ultramicrotome FC6
  - Equipped with an FC6 cryo-chamber for cryo-ultramicrotomy

# Faculty of Materials Engineering

## Electron Microscopy Center

### Electron Microscopy Center

- **Transmission Electron Microscope - FEI Titan 80-300 kV FEG-S/TEM**
  - The Titan 80-300 FEG-S/TEM (FEI) is an all-new platform dedicated to correction and monochromator technology. The Titan S/TEM system is the world's highest resolution commercially-available microscope
- **Scanning Electron Microscope - FEI E-SEM Quanta 200**
  - An environmental SEM, enabling characterization of non-conducting without a conductive, and is equipped with EDS (light element), WDS and EBSD.
- **Plasma Cleaner**
  - Fischione plasma cleaner – model 1020
- **Transmission Electron Microscope - FEI Tecnai G2 T20 S-Twin TEM**
  - A 200kV (or 120kV) TEM with a LaB6 electron source and an FEI Supertwin Objective Lens
- **Electron Microscopy Specimen Preparation Lab**
  - The lab includes: variable speed grinder/polishers, precision sectioning saw, semiautomatic grinder/polisher, Gatan 656 Dimple Grinder, Polaron gold and carbon coaters, Fischione plasma cleaner, Gatan 691 Precision Ion Polishing System (PIPS), IV8 Gentle Mill – low energy ion miller and a Microtom system for soft materials sectioning
- **Light Microscopes**
  - Light microscopy is based on two metallurgical light microscopes: The Zeiss Axiophot which includes a CCD and video printer system. A Reichert Polyvar Z microscope linked to a computer via a CCD for image analysis using the SIS Software Imaging System

### Wolfson Center for Interface

**Science** (located adjacent to the Electron Microscopy Center)

- **LEO Gemini 982**
  - A field emission gun SEM (FEG-SEM) which includes an in-lens detector for low voltage applications, an EDAX light-element EDS system, and an Oxford electron backscattered electron diffraction system (EBSD).

### Microelectronics center in

**Zisapel building** (This system is located at the Microelectronics center in Zisapel)

- **FEI Strata 400S Dual Beam FIB**
  - The Strata 400 STEM Dual-Beam system is a fully digital field emission scanning electron microscope (FEG-SEM) equipped with FIB technology and a Flipstage-STEM assembly. It provides for complete in-situ sample preparation and high-resolution analysis.

# Solid State Institute

## Surface Characterization Center

### Surface Characterization Center

- SIMS – Secondary Ion Mass Spectrometry (Cameca ims4f)
  - Trace and major elements analysis, including hydrogen, in solids and thin films. Depth profiling from small areas with detection sensitivity in the ppm-ppb region
- XPS – X-ray Photoelectron Spectroscopy (Thermo VG Scientific Sigma Probe)
  - Small area chemical analysis of solid surfaces with chemical bonding information obtained by using a microfocused (from 15 to 400  $\mu\text{m}$ ) monochromated x-ray source
- SAM – Scanning Auger Microscopy (Thermo VG Scientific Microlab 350)
  - Elemental analysis of solid surfaces with high spatial resolution (7 nm in SEM and 12 nm in Auger modes). Depth profiling with excellent depth resolution.
- TOF-SIMS – Time of Flight Secondary Ion Mass Spectrometry (Ion ToF TOF-SIMS V)
  - Shallow depth profiling and imaging of thin layers with nanometer scale depth resolution, submicron lateral resolution and ppm sensitivity

### Other equipment located in the Solid State Institute Center (On a different floor)

- STM/AFM - Scanning Tunneling/Atomic Force Microscopy (Omicron UHV SPM)
  - Structural surface analysis with atomic resolution. Local topography, electronic and chemical properties of solid surfaces with nanometer spatial resolution
- NSOM/AFM - Near-field Scanning Optical/Atomic Force Microscopy
  - Simultaneous characterization of solid samples by AFM and NSOM at temperatures between 10 to down to 300K.
- HR XRD – High Resolution X-ray Diffraction (Philips Four Crystal Diffractometer)
  - Characterization of thin epitaxial layers. Composition, layer thickness, state of relaxation as well as periods and mean mismatch of superlattices in multilayered structures can be determined.
- Micro Raman Spectroscopy (Dilor Double Spectrometer)
  - Characterization of crystal quality and microstructure of solid materials and epitaxial layers with spatial resolution as low as 1 $\mu\text{m}$
- Ion Implantation (HVEE 320 keV Ion Implanter)
  - Ion implantation into semiconductors and other materials at various temperatures, doses and energies.



# Faculty of Biology

## Infrastructure Center for Life Sciences

- **Illumina Genome Analyzer Iix**
  - The platform employed in the Illumina System applies parallel, shotgun, clonal sequencing-by-synthesis (SBS) of millions of immobilized oligonucleotides that are repetitively sequenced using reversible fluorescence-based terminator chemistry
- **LSM 700 - Inverted confocal microscope**
  - The LSM 700 laser scanning confocal microscope from Zeiss is a spectral imaging confocal system designed for live-cell imaging
- **Laser Flow Cytometer Sorter (BD FACS Aria- II)**
  - The digital FACS ARIAL is a stream-in air sorter capable of separating up to four different populations or single cells (<300 to 70,000 events/second) and depositing them into test tubes, microtiter plates or slides
- **Laser Flow Cytometer Analyzer (BD LSR-II)**
  - The BD LSR II is configured with four fixed-aligned air-cooled lasers (488 nm, 405 nm, 633 nm, and 325nm UV), 10 fluorescent detectors and two physical detectors
- **Dimensional Microscope for Living Cells (Zeiss Cell Observer Imaging System)**
  - This optical microscopic system is ideal for imaging of tissue culture cells using transmitted light, Nomarski optics and epi-fluorescence.
- **Multiphoton Multispectral Laser-Scanning Microscope (Zeiss LSM 510 META NLO)**
  - The Laser Scanning Confocal Imaging System is a microscope that uses lasers to visualize fluorescent markers

# Faculty of Bio-Medical Engineering

## Biomechanics and Tissue Engineering Center

- OPTICAL TWEEZERS (**currently located in the Faculty of Physics**)
  - The PALM Microtweezers is a fully automated optical manipulation system used to trap dielectric microspheres, viruses, bacteria, living mammalian cells, organelles, liposomes, small metal particles, and even strands of DNA
- LASER MICRO-DISSECTOR
  - The PALM MicroBeam C laser micro-dissector is a fully digitized and computer controlled microscopy system offering new possibilities in live-cell applications

# Faculties of Chemical Eng. and Biotechnology and Food Eng.

## X-Ray and Particle Characterization Facilities

### Nanometric Systems Characterization Center

- AFM/SPM 120-XE
  - AFM for a multitude of applications in Soft Matter and Life Science research. Can be used in nanomanipulation and cell adhesion measurements, surface chemistry, DNA high resolution imaging, bacteria, polymer melting
- BI-200SM Research Goniometer System
  - The BI-200SM Research Goniometer System is designed for both static and dynamic light scattering measurements
- FluoroLog 3-22- Modular Spectrofluorometer
  - Provides the fluorescence measurements with very high sensitivity, allowing detecting very low concentration of fluorescence.
- NanoWizard® II BioAFM
  - AFM imaging
- BI-DNDC: Differential Refractometer
  - The BI-DNDC is a deflection type refractometer that may be purchased for use in either batch or GPC/SEC mode

### X-Ray Lab

- Small-angle x-ray scattering (SAXS)
  - Small-angle x-ray scattering (SAXS) is a well-established technique for studying structural features of colloidal or nanometric dimensions (1-100 nm)

Note: The small-angle X-ray scattering facility at the Technion includes 3 sub systems. Currently only the JJ System is fully operating.

### Lab room #311

- Advanced Spectrometer
  - The instrument is capable of scanning excitation and emission spectra, either in cuvettes (temperature control and titration available) or in 96 well plates

Computer Center  
Center for Computational  
Nanoscience and  
Nanotechnology

- NANCO computer cluster
  - The computer facilitates parallel computation

Faculty of Chemistry

- Solid State NMR
  - Solid State NMR Spectrometer

- For additional information pls. contact the RBNI staff
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  - Web site: <http://rbni.technion.ac.il>

Pls. note: Beginning next week, contact details for direct booking via the infrastructure centers contact people (including equipment description and rates) will be published on the RBNI web site