



## FACT SHEET

### **BINNIG AND ROHRER NANOTECHNOLOGY CENTER**

*A collaboration in nanoscience between IBM Research and ETH Zurich*

#### **BUILDING**

- Location: Campus of IBM Research - Zurich in Rüschlikon, Switzerland
- Construction period: March 2009 to spring 2011
- Base area (footprint per level): 1500 m<sup>2</sup>
- Total floor space: 6500 m<sup>2</sup>
- Building dimensions: Length = 50 m, width = 30 m

#### **COOPERATION MODEL**

- Investment of \$90 million (incl. \$30 million for equipment, which is shared by IBM and ETH Zurich)
- IBM constructs and owns the building.
- ETH Zurich rents space for a minimum of 10 years.
- Shared use of the cleanroom for both joint and individual research projects



*In the 950 m<sup>2</sup> state-of-the-art cleanroom, IBM and ETH Zurich scientists will work side-by-side.*

#### **RESEARCH PROJECT AREAS**

Working with partners, the Nanotechnology Center will focus on several areas including micro-/nanoelectromechanical systems (MEMS/NEMS); spintronics/magnetism; nanowires; carbon-based devices; organic electronics; functional materials; directed self-assembly; cooling; three-dimensional integration; optical interconnects; photonics; and simulation and theory.



*Solar panels on the roof of the building have a nominal electrical power of 38 kW.*

#### **SUSTAINABILITY IN THE USE OF NATURAL RESOURCES**

The new Nanotechnology Center will continue IBM's tradition of environmental awareness and has been granted the use of the MINERGIE standard quality label. MINERGIE status is granted to new and refurbished low-energy-consumption buildings in Switzerland.

To reach this standard, IBM is utilizing several innovations including a photovoltaic power system, a geothermal heat exchange system, heat recovery windows and cutting-edge climate systems.

The roof of the underground garage at the Nanotechnology Center features a special layer of stones, sand and earth which will provide a new habitat for a variety of native plants, reptiles and insects.

## INFRASTRUCTURE FOR CUTTING-EDGE RESEARCH

### Cleanroom for Micro and Nanofabrication

The Nanotechnology Center features a 950 m<sup>2</sup> cleanroom facility for micro and nanofabrication with a cleanroom class ranging from 100 (ISO 5) to 10,000 (ISO 7). The cleanroom will be used for exploratory research on new materials and new devices with dimensions down to the nanometer scale. It is not a production or pilot line with fixed processes and fixed wafer size; flexibility is of utmost importance.

Processes, most of which will be semiconductor-based, will be conducted on materials similar to those used in standard semiconductor technology, such as silicon, germanium, III-V semiconductors, carbon, graphene, metals, insulators, polymers, organics and oxides. Small pieces to 6-inch wafers can be processed; for some tools, wafers up to 200 mm in size will be possible.

The cleanroom consists of different sectors with a broad set of processing tools:

- Lithography for pattern definition by optical contact printing and direct laser writing
- Wet processing for substrate cleaning and wet chemical etching
- Dry etching for material removal using plasmas of reactive gases
- Thermal processing using oxidation, annealing and vapor phase deposition
- Thin-film deposition using sputtering tools, evaporators, chemical vapor deposition and atomic layer deposition
- Back-end processes such as lapping/polishing, dicing, chemo-mechanical polishing (CMP), electroplating, and bonding
- Metrology/characterization using optical microscopes, SEM, AFM, FIB, and ellipsometry
- Waveguide processing for optical interconnects

*More details on the cleanroom can be found in the separate Fact Sheet Cleanroom.*

### “Noise-free“ Labs

Research at the nanometer scale requires fabrication and characterization of nanoscale structures, whose level of accuracy is also at the nanometer scale. As a consequence, experiments are becoming increasingly sensitive, particularly regarding external sources of noise such as temperature fluctuations, vibrations, electromagnetic stray fields and acoustic disturbances.

In order to screen external sources of noise and minimize internally created noise sources, six cutting-edge research labs with a total floor space of 176 m<sup>2</sup> were installed in the basement of the new nanotechnology center. These labs are equipped with the following facilities:

- Chamber and auxiliary room: Noisy equipment such as pumps, transformers, chillers etc. is located in auxiliary rooms adjacent to every lab. The operator and the instrumentation are also stationed in a separate anteroom close to the main lab. Only the core experiment setup is located in the sensitive area.
- Electromagnetic field compensation: Every lab has a complete magnetic cladding (NiFe) to shield it from electromagnetic fields. To compensate for DC components and internally created fields, an active Helmholtz coil system applies a counterfield that reduces the fields to less than 2 nT AC (absolute) and less than 20 nT DC (fluctuations on top of the magnetic field of the Earth).
- Vibrations: The test beds of every lab are equipped with seismic blocks weighing between 30 and 68 tons, which are actively suspended on air springs. In addition, users walk on a separate platform decoupled from the test bed.
- Air-conditioning system: A laminar, non-turbulent air-conditioning system keeps the temperature stable within  $\pm 0.01$  °C and the humidity within  $\pm 5\%$ . The acoustic emission of the entire system is less than 21 dBC.

*More details on the “noise-free” labs can be found in the separate Fact Sheet Noise-free Labs.*