

A.P.E. Research srl

**A LEADING NANOTECH
COMPANY**

“Nanotechnology is the understanding and control of matter at dimensions of roughly 1 to 100 nanometres, where unique phenomena enable novel applications.

At this level, the physical, chemical, and biological properties of materials differ in fundamental and valuable ways from the properties of individual atoms and molecules or bulk matter”.

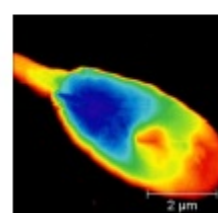
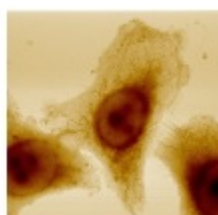
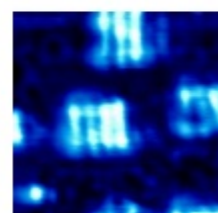
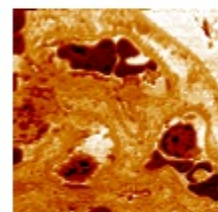
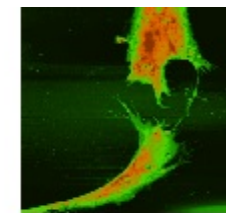
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AREA
SCIENCE PARK

Who we are:

A.P.E. Research (Applied Physics and Engineering Research - APE) is an high-tech company specialised in the production of advanced instrumentation in the field of NanoTechnologies .

A.P.E. Research provides top level scientific instrumentation for research institutes and for industries: instrumentation for surface analysis, such as Scanning Probe Microscopes (SPM), profilometers and different kinds of electronic devices.

Main applications are in fields of basic sciences: chemistry, physics and biology.

Based in Trieste, APE is a dynamic company with over 20 years experience in nanotechnology.



As a part of **Trieste's Science System**, APE mission is to promote the state of art of technology for everyday and advanced applications, with special focus to **support Universities, Research and Training centres**.

A.P.E. Research invested a lot on the latest **AFM**, making it more affordable for researchers. This would enable more and more researchers to perform advanced research studies, favouring the growing demand for SPM products and **promoting scientific capacity and excellence for science-based development**.

A.P.E. Research supports the idea of **human mobility and training on nanotechnologies**, which have been recognized by the EU as one of the four key enabling technologies. It also stresses that the **Trieste Science System** can offer a comprehensive approach on nanotechnologies.

SCANNING PROBE MICROSCOPES.

These are particular types of microscopes that exploit physical variables in order to construct an image with high magnification. The technique is very simple to explain: a sharp probe is positioned close to the surface (a few nanometers, billionth of meter) and runs across the sample surface, measuring the interaction between the probe and the surface at each point.

According to the physical variable analyzed, SPM are divided into:

- **SNOM** (Scanning Near-field Optical Microscope): resolutions of up to 10 nanometers, unique capability to provide simultaneously topographic and optical images.
- **AFM** (Atomic Force Microscope): resolutions of up to 0,1 nanometer, makes it possible to obtain images of DNA, cells, small molecules, polymer.
- **STM** (Scanning Tunneling Microscope): resolutions of up to 0,1 Å⁰, able to provide images of single atoms.

Benefits of using SNOM, AFM, STM systems comparing to classical imaging:

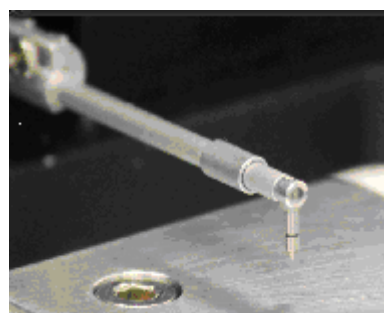
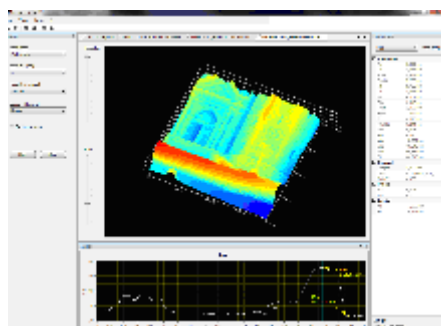
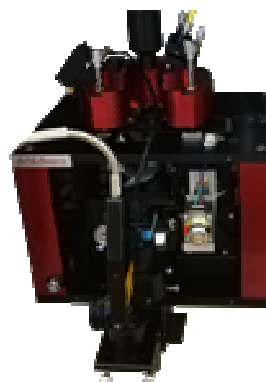
Conventional microscopy techniques (like optical microscopy and electron –SEM, TEM-microscopy) are 2D (two-dimensional) techniques that provide an (xy) image of a plane of the sample, on the contrary **SPM microscopies present the unique capability to give a 3D images** of the sample morphology.

Indeed SPM techniques allow a direct measure of the heights (z) of the ultrastructures at nano-scale level, providing an accurate three-dimensional reconstruction of the sample surface.

Innovative aspects. Scanning probe microscopes (SPM) is a class of instruments able to distinguish the arrangement of the single molecules on the crystalline surfaces of the materials. These microscopes can also operate in gaseous or liquid environments and in general do not require preliminary treatment of the samples; they are therefore also suitable for biological material.

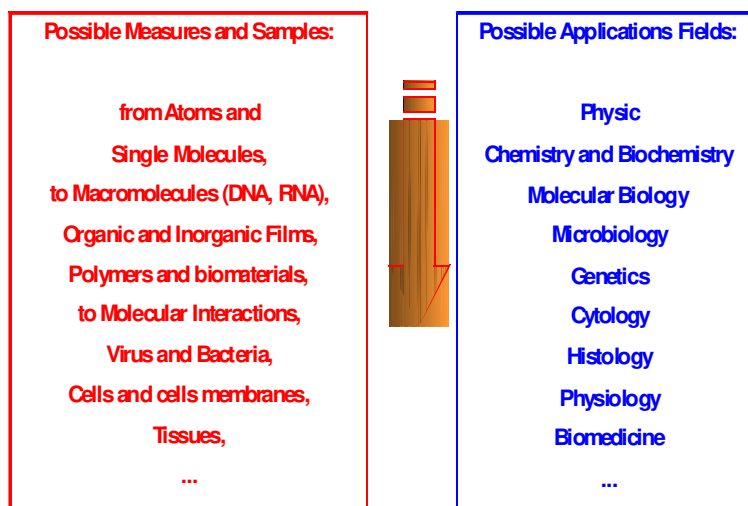
Integration

The strength of A.P.E. Research is also in our ability to create instruments - like **SPM** and **profilometers** - that meet our customers' needs. Our **SPM** are designed to be **integrated** seamlessly with other systems like **RAMAN**, and other devices, for scientists who need research-grade performances and ease of use.



APPLICATIONS

SPM: Applications Fields



SPM works in **Air** or in **Liquid** ambient

Sector	Application examples	Instruments
Metallurgy	Characterization microstructure of metals	AFM, STM
Synthetic resins	Roughness and chemical contrast of rubber and plastics	AFM
Precision mechanical	Analysis of the structures obtained by laser ablation	AFM
Optical Industry	Check quality parameters of coatings	AFM, SNOM
Electronics	Analysis of micro-electronic circuits and electronic devices	STM, AFM
Wood	Check woodsanding wood	AFM
Biology	Analysis of cell and tissue biology	AFM, SNOM
Powders	Dimensional Analysis	AFM
Biomed	Characterization of biomedical implants	SFM, AFM

BIONANOLAB

A.P.E. Research BioNanolab is aimed to research groups in the academic world and to the manufacturing sector which bases its competitiveness on technical-scientific innovation. It provides state-of-the-art tools, skills and supports the experimentation of new technologies useful for fueling the research and development process of products and production processes.

Operatively APE operates:

- 1) activating technological platforms for laboratory for which APE has the skills as the only Italian manufacturer of Scanning Probe Manufacturer;
- 2) making available its know-how and its own specialized personnel, regarding the end user fields of interest.

SPM (probe scanning microscopes) are highly versatile instruments that can be used for a wide variety of applications: metallurgy, semiconductor technology, surface study, magnetic materials, polymer science, composites, optics, chemistry, biology and medicine.

A.P.E. Research makes available, through its BioNanolab, sophisticated instruments, services and know-how in the measurement sector.

A.P.E. Research operates with a highly specialized "Multidisciplinary Team" made up of electronic and mechanical engineers, physicists, chemists and biologists.

This team allows to analyze together with the user his real needs, plan the proper training activities and then develop the most suitable set-up for his specific research activity.

A.P.E. Research



A100 AFM System



TriV-SFM Microscope



A100 AFM Microscope

Sample images from SPM

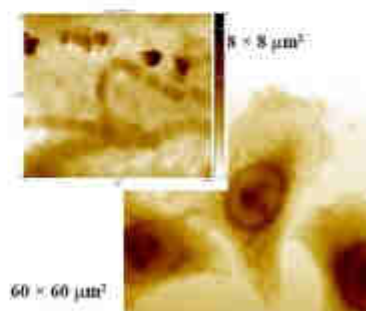
Cu-Phthalocyanine nanowires on silicon and Kelvin Probe



Electronic device and Electrostatic Force



Cells

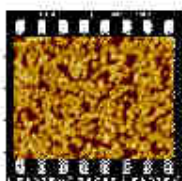


DNA molecules on MICA

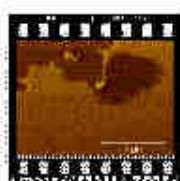


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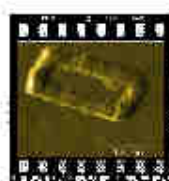
SOME SPM IMAGES AND TECNQUES



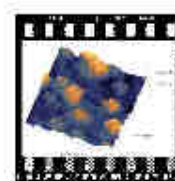
TiO₂
nanoparticles



Phase contrast
Co-polymeric film



Lateral force on
In₂O₃Sn₁₀



3D rendering of
CuInS₂



EFM map
HFB assemblies on Si



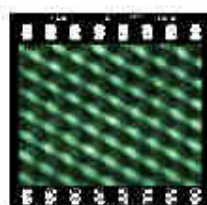
ITO
conductive map



Kelvin potential map on a circuit



Nanolithography



Photocrystal
SNOM collection mode



Piezo force on PPLN

SOME OF OUR USERS WORLDWIDE



SOME OF OUR R&D PROJECTS

