

Bionanomanufacturing

Bio-Nano Manufacturing technology platforms

One of the major challenges of this century is the development of new products and industrial processes while also considering resource sustainability as well as their social, economical and environmental impact.

The technology platforms of biotechnology, nanotechnology, microtechnology and ultra-precision metrology are key for advancing sustainable development, while maintaining the competitive advantages of companies. These platforms are the foundation of the Bionanomanufacturing laboratory which is operating in IPT's latest state of the art facilities.

Integration

The multidisciplinary nature of these platforms facilitates the creation of integrated technological solutions.

Nanotechnology offers new possibilities for scientific and technological development, reducing timescale and size, allowing for the intensification of chemical, physical and biological processes, and enhancing product quality and functionality.

Biotechnological processes aim for the advantage to be less harmful to the environment, consume less energy and favor the use of renewable raw materials.

Advances in micro-manufacturing enable the use of nanotechnology for the development of biosensors in health and environment-related areas, micro-reactors for chemical applications, miniaturized conventional analytical techniques, micro-electromechanical systems (MEMS), nano-electromechanical systems (NEMS) and others.

Ultra-precision metrology is not only used for the development and testing of bio-, nano- and microtechnology products and processes, but also provides services to other advanced areas of the industry.

Partnerships

Responding to market demands, Bionanomanufacturing at IPT is looking to enable the integrated and sustainable development and application of these technologies. Various types of co-operation, such as research, development, consulting and technology services are considered. A multitude of funding options for those partnerships with companies is available (including non-refundable resources from Brazil's National Research and Industrial Innovation Company – Embrapii).

The team at IPT is available to discuss those partnership opportunities. Contact us by email:

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For further information, visit our website at:

www.ipt.br/bionanomanufatura



Biotechnology

Sustainable solutions for the development of new products and processes



[left] Laboratory with automated bioreactors

[right] Biopolymer producing bacteria

The development of bioactive molecule production processes and the substitution of chemical routes by biotechnological routes are worldwide trends. In the field of biotechnology, IPT stands out for its ability to work in all the stages of bioprocess development, including isolation and selection of microorganisms, genetic studies, process development and optimization, purification and characterization of biomolecules, and processes up-scaling.

Technological Solutions

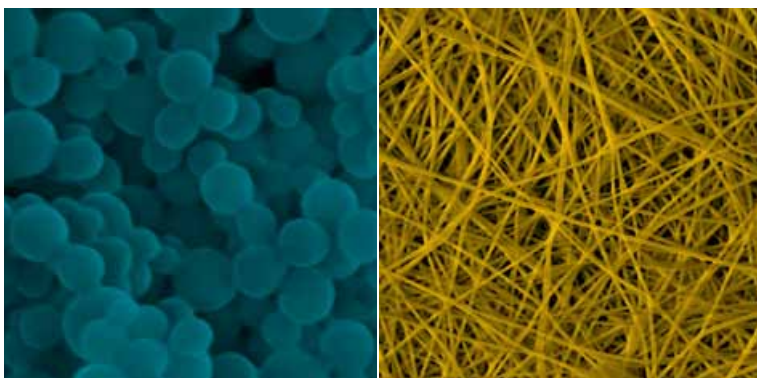
- Bioprospecting of new microorganisms
- Genetic improvement of microorganisms
- Metabolomics
- Bioprocess development and optimization
- Bioprocess scale-up
- Biomolecule purification and characterization
- In vitro evaluation of antimicrobial activity and cytotoxicity
- Evaluation of product biodegradability

Infrastructure (Facilities & Equipment)

- Automated bioreactors with 0.7L to 100L capacity
- Pretreatment system for lignocellulosic materials
- Chromatographs and mass spectrometers
- Gas analyzers (respirometers)
- Infrastructure for microorganism screening
- Infrastructure for cell culturing
- Centrifuges, ultracentrifuges and micro and ultrafiltration systems
- Thermocycler, transilluminator and lyophilizers
- Scanning electron and optical fluorescence microscopes
- Infrastructure for handling Class 1 and Class 2 bacteria

Nanotechnology

Solutions for nanoproduct synthesis and characterization



[left] Nanoparticles on a 3-micron scale

[right] Nanofibers produced by electrodiffusion

IPT works in the development of nanostructured systems through different production routes covering polymerization, spray drying, emulsification, solvent evaporation, coacervation, microfluidics and others. Characterization tools help exploring the behavior of nanostructures, thus allowing their properties to be used purposefully. This technology platform has an experienced team of researchers specialized in interfacial physicochemical phenomena and colloid chemistry, which also has an in-depth understanding of the principles that govern the characterization techniques used for nanotechnology products as well as specific expertise critical to the engineering of nanostructured materials.

Technological Solutions

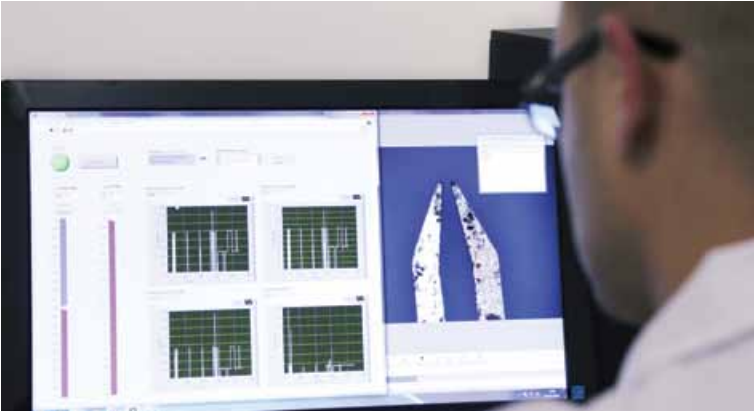
- Nanoparticle synthesis
- Production of polymeric nanofibers by electrospinning
- Functionalization of nanomaterials
- Development of complex fluids
- Controlled release systems
- Surface modification and functionalization
- Advanced techniques for the characterization of nanomaterials and complex fluids

Infrastructure (Facilities & Equipment)

- Automated reactors
- High pressure homogenizers
- Nano spray dryer
- High precision microscopes
- High precision particle size analyzers

Microtechnology

Solutions for the design, fabrication and characterization of miniaturized components and systems



Design of electro-thermal pincers using topological optimization tools and manufactured out of stainless steel with a micromachining laser

This technology platform is dedicated to the design, manufacturing and characterization of microsystems such as MEMS and biosensors. It can handle tasks ranging from the analysis of phenomena that may affect the design of microsystems, to the development and optimization of micromachining processes such as cleanroom microfabrication, ceramic multilayer processes and micromachining.

Technological Solutions

- Low Temperature Co-fired Ceramics
- LTCC microsystems
- Microdevices made of silicon, glass, polymeric materials and metal substrates
- Surface activation

Infrastructure (Facilities & Equipment)

- Experimental LTCC prototyping (machining, serigraphy, lamination, sintering and assembly)
- Thin and thick film deposition of various materials, including polymers
- Wet and plasma corrosion
- Photolithography
- Micromachining and laser microdrilling
- Micromilling with cutting tools
- Dimensional and geometric measurement of microstructures and microcomponents

Ultra-precision metrology

Solutions in dimensional and geometric metrology of parts and nondestructive analysis of materials



The X-Ray Computer Tomography allows the analysis of the internal and external structure of assembled parts as well as of homogeneous components.

IPT offers solutions for geometric and dimensional metrology using innovative measurement technologies such as 3D X-ray metro-tomography for complex devices and components of diverse geometries.

The close alignment of metrology with all steps of the development and manufacturing process of a product ensures highest standards of quality and therefore a competitive advantage.

Technological Solutions

- Dimensional and geometric metrology of parts with smooth or free surfaces
- Nondestructive measurement of internal details of components and parts of various materials (steel, aluminum, magnesium, titanium, ceramic and plastic)
- Digitizing of complete, composite components and complex mechanisms
- Detection and analysis of defects in materials, such as the presence of pores, cracks and contaminants

Infrastructure (Facilities & Equipment)

- 3D X-ray metrotomography system with multiple sensors
- Multisensor coordinate measuring machines
- Workstation with high processing capability with the following applications: VG Studio Max, SmartFit (comparison of point cloud obtained by tomography with the CAD model), SmartProfile (GD&T evaluation) and Geomagic (reverse engineering)

IPT

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