ADVANCED FUNCTIONAL NANOMATERIALS SCHOOL YACHAY TECH 2020

AFNS- YTU-2020

8th to 12th, February, Yachay Tech University, Urcuqui, Ecuador

Advanced Functional Nanomaterials School Yachay Tech University 2020

Welcome to AFNS-YTU-2020

On behalf of The School of Physical Sciences and Nanotechnology at Yachay Tech University in cooperation with the Prefalc Programme, we invite you to join us at the edition of the Functional Nanomaterials School @ Yachay Tech 2020 (AFNS-YTU-2020). The summer school will be held on 9th, 10th, 11th, 12th and 22nd of February 2020 at Yachay Tech University, in the Urcuqui, Ecuador. The AFNS-YTU-2020 will hold plenary sessions by top international invited talks from leading researchers in the field. We anticipate the participation of 50 attendees between speakers, professors, students in an informal atmosphere where they can openly discuss, exchange ideas and results about their latest work in different topics of nanotechnology and their application.

Professor Ernesto Medina

Dean of the School of Physical Sciences and Nanotechnology

Advanced Functional Nanomaterials

In the last decade, new trends involve the ability to fabricate, characterize, and manipulate artificial structures, whose features are controlled at the nanometer level. They embrace areas of research as diverse as engineering, physics, chemistry, materials science, and molecular biology. Research in this direction has been triggered by the recent availability of revolutionary instruments and approaches that allow the investigation of material properties with a resolution close to the atomic level. Strongly connected to such technological advances are the pioneering studies that have revealed new physical properties of matter at a level intermediate between atomic/molecular and bulk. Nanoscale materials frequently show behavior that is intermediate between that of a macroscopic solid and that of an atomic or molecular system. Actually, there are many additional properties specific to such systems that cannot easily be grasped by simple reasoning. These properties are related to the sometimes-counterintuitive behavior that

charge carriers (electrons and holes) can exhibit when they are forced to dwell in such structures. These properties can only be explained by the laws of quantum mechanics.

Through this course, we will study at the very beginning the Nanomaterials, focusing not only from the theoretical or practical point of view, but we also focus on their Safety and Environment implications. We will also study in detail nanocarbon materials, including their structure, growth mechanisms and their characterization using Raman spectroscopy. We also, develop the potential application of these macromolecules. Then, we will study Luminescent nanostructures in ceramic materials: quantum dots, the effect of high pressure, applications of luminescent ceramic materials. Besides theory, we want to introduce to the current synthesis techniques and characterization of Nanomaterials based on polymers for Health Applications, biomaterials/Drug Delivery Technologies. Followed by an Introduction to Global Energy Issues: i. Photovoltaic conversion, ii. Electrochemical storage and fuel cells. The course will finish on two topics regarding a theoretical/practical Introduction to Colloidal Synthesis of Nanomaterials and their Characterization in solutions and introduction to XPS for characterizing nanomaterials

Prefalc Programme

The PREFALC was created in 2003 by the Ministry of National Education, Higher Education and Research (MENESR), the Ministry of Foreign Affairs and International Development (MAEDI), and the Foundation Maison des Sciences de l' Homme (FMSH). The French National Research Institute for Sustainable Development has also been a strategic partner from 2007 until 2017. This project supports university cooperation projects between French, Latin-American and Caribbean higher education institutions.

PREFALC allows to finance for two years the mobility of lecturer-researchers teams from French higher education institutions, who want to carry out teaching missions at master level in partnership with at least two Latin-American and/or Caribbean universities, in following areas:

- Social sciences and humanities,
- Information and communication sciences,
- Agronomic and ecological sciences,
- Physical and chemical sciences,
- Medicine and human biology,
- Mathematics,
- Science of the Earth and the Universe
- Engineering sciences,

5 projects have been selected to participate

1. Plateforme de detection d'evenements (pde)

2. Reflexions autour des projets d'architectures durables dans des contextes a risques
3. Prospective participative pour un developpement territorial articulant agriculture et villes moyennes en argentine, bresil et france
4. Reseau nano-fevb
5. Commande avancee : applications en robotique, bioprocedes, convertisseurs d'energie electrique et detection de defauts

Among the projects to be financed during the 2020-2022 period, the proposal called reseau nano-FEVB, where an Ecuadorian university participates, Yachay Tech University is the representative. The "Réseau Nano-FEVB" project has the objective of bringing together actors from the field of nanotechnologies with complementary skills that allow strengthening the interdisciplinary approach of the research axis to address potential applications of nanotechnologies in areas related to life sciences, Environment, and energy. This network will allow students to offer a wide range of training in nanomaterials that includes notions of sustainable development. Likewise, the exchange of teachers and researchers will be promoted, as well as discussion spaces that allow leading global reflections on the field of nanotechnologies and their potential applications in solving specific problems of societies.

Universities and research institutes from 4 countries participate:

- France.- Université de Montpellier, Polytech Montpellier et Laboratoire Charles Coulomb, Equipe Nanomatériaux y Université de Montpellier, Polytech Montpellier et Laboratoire Charles Gerhardt, Equipe ChV
- Venezuela.- Universidad Simón Bolívar (USB), Caracas, Departamento de Física.
- Brazil.- Universidade Federal do Río Grande do Sul (UFRGS), Laboratório de Altas Pressões e Materiais Avançados
- Ecuador. - Yachay Tech University (YT), Urcuquí, School of Physical Sciences and Nanotechnology and School of Biological Sciences and Engineering.

Activities planned for the year 2020:

1. School of Nanoscience and Nanotechnology 2020 (ENANO2020) from 1/2/2020 to 7/2/2020 (60 hours of course). Simón Bolívar University, Caracas Venezuela.
2. School on Applications of Nanomaterials from 2/8/202 to 2/15/2020 (60 hours of course). Yachay Tech University, Urcuquí, Ecuador.

3. FLOW School and international week of nanomaterials and their applications in the area of energy and Eco-design (October 2020), Polytech, Universite de Montpellier, Montpellier, France (60 hours of course).

Speakers

Eric Anglaret

Université de Montpellier, France
eric.anglaret@umontpellier.fr

Carbon Nanomaterials: structure and growth, Raman spectroscopy, properties and applications

Abstract

This course will be dedicated to the study of carbon nanomaterials: primarily fullerenes, carbon nanotubes and graphene. We will first address their synthesis methods, their structure and their electronic and optical properties, emphasizing how the reduction of size leads to dramatic changes in these properties. We will discuss why optical spectroscopies (absorption, Raman and photoluminescence) are powerful techniques to study these materials. Finally we will review the main physical and chemical properties of carbon nanomaterials and related possible applications.

Rozeen Le Parc

Université de Montpellier, France
Rozenn.Le-Parc@univ-montp2.fr

Global Energy Issues: i. Photovoltaic conversion, ii. Electrochemical storage and Fuel Cells

Abstract

In order to face energy issues, numerous energy conversion processes have to be considered and their efficiency boosted. Materials are highly involved in many of these conversion processes. From the knowledge of the physic and chemistry held behind, the requirements in terms of materials development can be identified, and good candidates therefore considered. Beyond the nature of the materials, their dimension also appears to be a key element. Indeed nanomaterials can on one hand be the answer for a lower consumption of non-renewable resources but also offer higher efficiencies through their specific properties. In this course, we will illustrate the gain brought by the use of nanomaterials, though some examples such as photovoltaic, fuel cells.

Christophe Blanc

Centre National de la Recherche Scientifique, France
christophe.blanc@umontpellier.fr

Nanomaterials in solutions: colloidal synthesis and characterizations

Abstract

In this course we will discuss the synthesis and the characterizations of nanomaterials in a liquid environment. Nanoparticles and nanostructured materials are indeed often synthesized in solutions via bottom-up routes. In these approaches, chemical and physical forces operating at the nanoscale are used to assemble basic units into larger structures of controlled morphology.

In a first step we will review the most important colloidal interactions and the mechanisms leading to the broad diversity of self-organized structures found in complex fluids. In a second step we will examine in detail a few examples where monodisperse nanoparticles or well defined nanostructured solids are obtained via reduction of salts, sol-gel approaches etc… and how they can be stabilized in solutions.

Finally the last sequence of the course will be dedicated to the description of classic tools (such as light scattering techniques, spectroscopies …) that can be used to characterize nanomaterials and follow their formation in solutions. We will present some techniques and their underlying mechanisms through a few basic examples where the size, the structure or the properties of the nanomaterials are monitored during their synthesis.

Naira Maria Balzaretti

Institute of Physics Universidade Federal do Rio Grande do Sul Porto Alegre, RS – Brazil
naira@if.ufrgs.br

Luminescent nanostructures in ceramic materials

Part 1 (2 h) - quantum dots
Definition
Electronic properties
Luminescence
Synthesis: semiconductors and carbon quantum dots

Abstract: Semiconductor nanoparticles smaller than 10 nm exhibit distinct properties that can be investigated considering the behavior of electrons in potential wells. The interaction of these structures with light promotes interesting luminescence effects associated with the size of the nanoparticle and to the functional groups on its surface. In this part, the definition, electronic properties and luminescence of quantum dots will be presented. Experimental aspects of synthesis and characterization of semiconductor and carbon quantum dots will be discussed.

Part 2 (2 h) - luminescent nanostructures in ceramic materials: effect of high pressure
Carbon quantum dots in silica produced by pyrolysis under high pressure
Fluorescent silica produced by high pressure sintering
Rare earth doped glasses containing metallic nanoparticles (nanoantenna effect)

Abstract: In this part, experimental aspects of the synthesis of carbon quantum dots in silica produced by pyrolysis under high pressure will be presented. The luminescent properties of the quantum dots will be discussed. In addition, the synthesis and luminescent properties of heavy metal glasses ($PbO\text{-}GeO_2$ matrix) doped with rare earth ions (Sm, Nd, Pr) containing metallic nanoparticles will be presented. The effect of densification under high pressure on the luminescence properties will also be discussed. It will be shown that the luminescent properties can be amplified or hindered in the presence of the metallic nanoparticles (plasmon effect) under high pressure.

Part 3 (2 h) - applications of luminescent ceramic materials

Solar cells
Biomedicine
Photonics
Laser

Abstract: some examples of application of quantum dots and luminescent ceramic or glasses will be presented. The idea is to connect the effect of the interaction of light with these structures with practical applications such as in the conversion of light into electrical energy (solar cells); use of light conversion to interact with human tissues; especially for bioimaging (biomedicine); use of light (usually infrared) for telecommunication and other devices (photonics), and for laser applications. Quantum dots and luminescent ceramics can increase the efficiency and effectiveness of these devices.

Frank Alexis

Yachay Tech University, Ecuador
falexis@yachaytech.edu.ec

Biomaterial/Drug Delivery

Abstract

The lectures will cover the science and clinical application of biomaterials. A biomaterial is now defined as a substance that has been engineered to take a form which, alone or as part of a complex system, is used to direct, by control of interactions with components of living systems, the course of any therapeutic or diagnostic procedure. The scope of the lecture covers the wide range of physical, biological and chemical sciences that underpin the design of biomaterials and the clinical disciplines in which they are used. Clinical applications include the therapies of medical technology and regenerative medicine in all clinical disciplines, and diagnostic systems that reply on innovative contrast and sensing agents. The course is relevant to areas such as cancer diagnosis and therapy, implantable devices, drug delivery systems, gene vectors, bionanotechnology and tissue engineering. Drug delivery is the method or process of administering a pharmaceutical compound to achieve a therapeutic effect in humans or animals. For the treatment of human diseases, nasal and pulmonary routes of drug delivery are gaining increasing importance. These routes provide promising alternatives to parenteral drug delivery particularly for peptide and protein therapeutics. For this purpose, several drug delivery systems have been formulated and are being investigated for nasal and pulmonary delivery. These include liposomes, proliposomes, microspheres, gels, prodrugs, cyclodextrins, among others. Nanoparticles composed of biodegradable polymers show assurance in fulfilling the stringent requirements placed on these delivery systems, such as ability to be transferred into an aerosol, stability against forces generated during aerosolization, biocompatibility, targeting of specific sites or cell populations in the lung, release of the drug in a predetermined manner, and degradation within an acceptable period of time.

Fig.1 Biomaterial/Drug Delivery

Carlos Reinoso Jerez

Yachay Tech University, Ecuador
creinoso@yachaytech.edu.ec

X-Ray Photoelectron Spectroscopy (XPS/ESCA), Introduction, Sample Preparation and Data Processing

Abstract

XPS is a surface characterization technique used to determine not only the atoms presence at a surface, but their concentration and specially their chemistry environment.
Objectives: To earn an overview of XPS characterization technique, going from the measuring process to data interpretation.

Introduction: The principles of XPS – production of photoelectrons, peak labeling, electronic configuration of atoms, binding energies of atoms, molecules and solids, kinetic energy, spectra, Auger process, valence spectra, handbooks, books, surface sensitivity, inelastic mean free path and databases, spin-orbit splitting, chemical shift, curve fitting using software, plasmons, multiplet splitting, shake-up.

Instrumentation: Monochromatic source, electron energy analyzers, spectrum acquisition, energy resolution, scattering in analyzers, electron detectors, position sensitive detectors, small area analysis, area location, imaging XPS, methods for imaging, software to improve information in images, energy scale calibration, vacuum system, samples exploration, qualitative analysis, quantitative analysis, background subtraction with examples using software, measuring peak areas, using software for quantitative analysis.

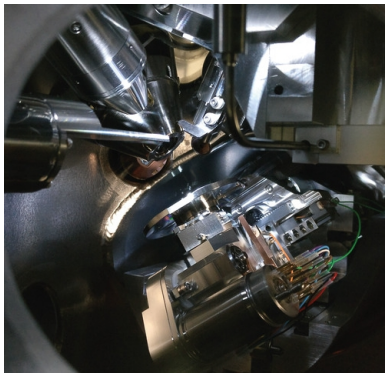


Fig 1. X-Ray Photoelectron Spectroscopy

Luis Carrión Matamoros

La Universidad de las Fuerzas Armadas – ESPE
lmcarrion1@espe.edu.ec

Introduction to Rheology and its technological applications

Abstract
The Rheology is the study of deformation and flow of matter, which describes the interaction between force, time and deformation. In this short course we will discuss basic concepts of Rheology such as: i.- classification of fluids; ii.- viscous fluids independent of time: reo-fluidizing, reo-thickening, viscoplastic; time-dependent viscous fluids, thixotropy; viscoelastic fluids and we will discuss the equations that governs fluids under different conditions. Finally we will discuss the Rheometry, and how to carried out measurements of rheological properties and their technological and industrial applications.

Christian Narváez

La Universidad de las Fuerzas Armadas – ESPE
cpnarvaez1@espe.edu.ec

Introduction to electrospining and their potential applications

Abstract
The Electrohydrodynamic [EHD] of liquids is a transport phenomenon that describes the form that a liquid set in motion assumes when it is subjected to strong electric field. Depending on the properties of the fluid a jet can be emitted from the apex of the Taylor cone, this jet can be of micro or nano-meter dimensions. Tailoring the liquid properties enables the production of nanoparticles or nanofibers. If the viscosity of the liquid is sufficiently high this capillary jet remains intact and can be deposited on a substrate forming a nanofiber mesh, this phenomenon is known as electrospinning. On the other hand, solutions with lower viscosity results in uniform jet break up and the production of micro or nanometer sized particles known as electrospray. The electrospinning/ electrospraying processes are highly versatile and low-cost methods of producing nanofibres and nanoparticles with a wide range of properties depending on the liquid solutions. Additionally it is possible to functionalize nanofibres by incorporating suitable materials in the liquid solutions use to generate the fibres. The electrospinning method has been previously demonstrated for use in advanced materials generation. The meshes generated by the electrospinning process can be tailored to have a high surface area-to-volume ratio and high porosity to mimic the features of the collector matrix.

Venue

Yachay Tech University

Yachay Tech University is a public university founded in March 2014, whose aim is to position Ecuador as a center of innovation and technological excellence in Latin America. Yachay Tech is a highly interdisciplinary institution that has been conceived with the philosophy of stimulating fundamental research, encourage scientific learning and it rewards academic and research excellence. Our five Schools (Biological Sciences and Engineering, Chemical Sciences and Engineering, Geological Sciences and Engineering, Mathematical Sciences and Information Technology, Physical Sciences and Nanotechnology) embody the concept of close interaction between fundamental discovery and application, each consisting of two departments, one concentrating on basic science and the other on technology and engineering.

Ecuador

Ecuador is a country located in South America with an area of 283.561 sq. km (Including the Galapagos Archipelago and the territorial sea). According to a study carried out by Conservation International, Ecuador is ranked among the 17 "mega diverse" countries and is the country with the highest diversity per square Km. Ecuador is divided into 24 provinces and has four diverse and rich regions: Galapagos, Pacific Coast, Andes, and the Amazon. Ecuador was awarded South America's Leading Green Destination in 2016 by the World Travel Awards. The main cities have international recognition. Quito and Cuenca have been recognized as World Heritage Patrimonies by UNESCO while Guayaquil has been recognized as a model for Human Development and Urban Regeneration.

Arriving to Ecuador

Yachay Tech University is located in a valley in the Andes Mountains in the San Miguel de Urcuquí canton, in the northern Imbabura province of Ecuador. Arriving at Yachay Tech University is not as difficult as it sounds. The important part is arriving in Ecuador.

Arriving at Quito

Quito is the capital of Ecuador and is located 2 hours away from Ibarra.

The government-run Ministerio de Turismo (http://ecuador.travel) is responsible for tourist information at the national level. Many towns have some form of the municipal or provincial tourist office.

Arriving at Ibarra

Ibarra is the capital of Imbabura, located 30 minutes away from Yachay Tech campus by car. It is known as the "White City" or the "La Ciudad a la que siempre se vuelve", because of its picturesque countryside, summer weather and the kindness of its inhabitants.

Bus

"Terminal Terrestre de Ibarra"

A big bus station where you can find buses to Urcuquí, Cotacahi, Otavalo and across the province of Imbabura, as well as transportation to Quito and Tulcán. Fares are very cheap, i.e. $3 to go to Quito.

Address: Teodoro Gómez de la Torre Ave. and Fray Vacas Galindo St.

A bus from Ibarra to Urcuquí will cost $0, 60 and it will drop you off at the Cemetery of Urcuquí.

Taxi

Ibarra – Urcuquí: $10

Around Ibarra in the morning: minimum fee $1, 25

Around Ibarra after 19:00: minimum fee $1, 50

Arriving at Urcuqui

Urcuquí is the nearest town where you can find different services. It is 10 minutes away from campus by car and 40 minutes by walking. It offers more restaurants, shops, services and a marketplace for fresh products.

Bus

A bus from Urcuqui to Yachay Tech will cost $0, 35

Taxi

Urcuquí - Yachay Tech: $2.00

Bus

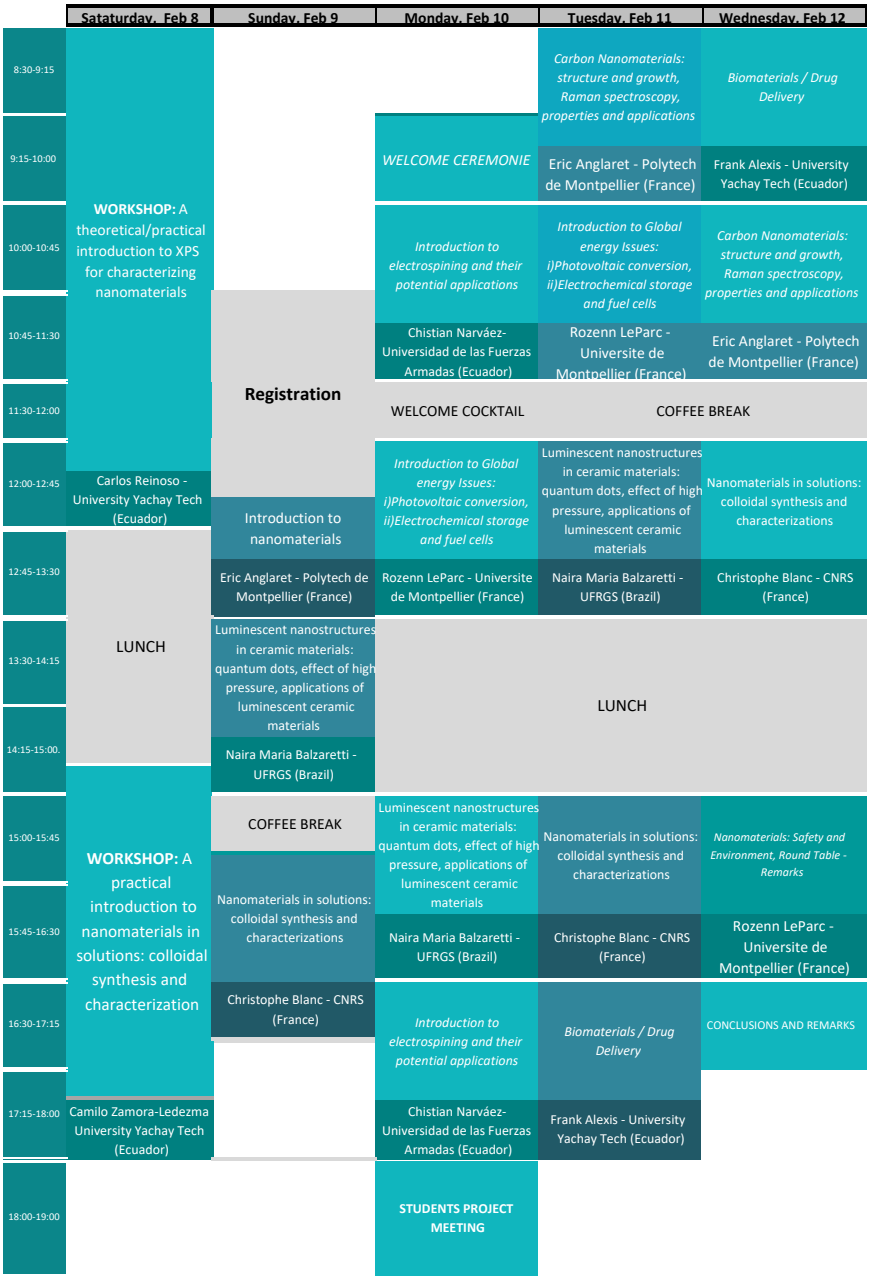
“Terminal de Carcelen-Quito”

A big bus station where you can find buses to the province of Imbabura, A bus from Quito to Ibarra will cost $3.

Taxi

Quito (Airport) – Ibarra $ 55-$70

Final Program



	Sataturday, Feb 8	Sunday, Feb 9	Monday, Feb 10	Tuesday, Feb 11	Wednesday, Feb 12
8:30-9:15	**WORKSHOP:** A theoretical/practical introduction to XPS for characterizing nanomaterials			*Carbon Nanomaterials: structure and growth, Raman spectroscopy, properties and applications*	*Biomaterials / Drug Delivery*
9:15-10:00			*WELCOME CEREMONIE*	Eric Anglaret - Polytech de Montpellier (France)	Frank Alexis - University Yachay Tech (Ecuador)
10:00-10:45			*Introduction to electrospining and their potential applications*	*Introduction to Global energy Issues: i)Photovoltaic conversion, ii)Electrochemical storage and fuel cells*	*Carbon Nanomaterials: structure and growth, Raman spectroscopy, properties and applications*
10:45-11:30		**Registration**	Chistian Narváez-Universidad de las Fuerzas Armadas (Ecuador)	Rozenn LeParc - Universite de Montpellier (France)	Eric Anglaret - Polytech de Montpellier (France)
11:30-12:00			WELCOME COCKTAIL	COFFEE BREAK	
12:00-12:45	Carlos Reinoso - University Yachay Tech (Ecuador)	Introduction to nanomaterials	*Introduction to Global energy Issues: i)Photovoltaic conversion, ii)Electrochemical storage and fuel cells*	Luminescent nanostructures in ceramic materials: quantum dots, effect of high pressure, applications of luminescent ceramic materials	Nanomaterials in solutions: colloidal synthesis and characterizations
12:45-13:30	LUNCH	Eric Anglaret - Polytech de Montpellier (France)	Rozenn LeParc - Universite de Montpellier (France)	Naira Maria Balzaretti - UFRGS (Brazil)	Christophe Blanc - CNRS (France)
13:30-14:15		Luminescent nanostructures in ceramic materials: quantum dots, effect of high pressure, applications of luminescent ceramic materials	LUNCH		
14:15-15:00.		Naira Maria Balzaretti - UFRGS (Brazil)			
15:00-15:45	**WORKSHOP:** A practical introduction to nanomaterials in solutions: colloidal synthesis and characterization	COFFEE BREAK	Luminescent nanostructures in ceramic materials: quantum dots, effect of high pressure, applications of luminescent ceramic materials	Nanomaterials in solutions: colloidal synthesis and characterizations	*Nanomaterials: Safety and Environment, Round Table - Remarks*
15:45-16:30		Nanomaterials in solutions: colloidal synthesis and characterizations	Naira Maria Balzaretti - UFRGS (Brazil)	Christophe Blanc - CNRS (France)	Rozenn LeParc - Universite de Montpellier (France)
16:30-17:15		Christophe Blanc - CNRS (France)	*Introduction to electrospining and their potential applications*	*Biomaterials / Drug Delivery*	CONCLUSIONS AND REMARKS
17:15-18:00	Camilo Zamora-Ledezma University Yachay Tech (Ecuador)		Chistian Narváez-Universidad de las Fuerzas Armadas (Ecuador)	Frank Alexis - University Yachay Tech (Ecuador)	
18:00-19:00			**STUDENTS PROJECT MEETING**		

Registration Process

We are happy to receive you this year at AFNS-YTU-2020. Please follow the steps below for a successful registration:

1. Complete the following registration form with your email https://forms.gle/6YSVntKRtTCfhUc58. (Open December 15th, 2019)
2. After acceptance, a notification will be sent to participants with instructions for the payment process.

We need to receive your payment until January 15th, 2020.
Note: Early payment is recommended. The number of participants will be strictly limited.
Early Bird Payment: December 20th, 2019

Registration fees

The full registration fees will be $ 150 Professionals and Students. Payment due date 7th February.
Financial institution: Banco del Pacífico
Account holder: Universidad de Investigación en Tecnología Experimental Yachay
Bank account: 7762895 Account
Type: Current
RUC: 1768176820001

More information available at the web site: https://fnsy2020.wixsite.com/afns

Limited places: 50 max.

Organizing committee

Yachay Tech Unviversity

- Camilo Zamora-Ledezma
- Frank Alexis
- Ernesto Medina
- Bernardo Guerrero
- Daniela Negrete
- Lady Rios

Polytech Montpellier (UM)

- Rozeen Le Parc
- Eric Anglaret

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