

**REGISTRATION FORM (deadline for registration July 31, 2015)**

Mr., Ms., Dr., Prof. (circle one)

First Name: \_\_\_\_\_

Family Name: \_\_\_\_\_

Organization/Institution: \_\_\_\_\_

Address: \_\_\_\_\_

Postal Code: \_\_\_\_\_

City: \_\_\_\_\_ Country: \_\_\_\_\_

E-mail: \_\_\_\_\_

Phone: \_\_\_\_\_

Fax: \_\_\_\_\_

**ACCOMMODATION RESERVATION**

**Hotel NH Aranzazu\*\*\*\***

For reservation, please contact NH Aranzazu Hotel ([nharanzazu@nh-hotels.com](mailto:nharanzazu@nh-hotels.com), Phone: +34-943-219077. Fax: +34-943-219050), providing the reference "EMULSION COURSE 2015".

**Olarain Residence**

For reservation, please contact Olarain Residence ([reservas@olarain.com](mailto:reservas@olarain.com), Phone: +34-943-003300. Fax: +34-943-003309) for registration there, providing the reference "EMULSION COURSE 2015".

**FEES (Early registration till July 31, 2015)**

**In-site attendance** \_\_\_\_\_ 1,350 €

Late registration (after July 31, 2015) will have a charge of 100 € in the registration fee.

**METHOD OF PAYMENT**

Bank transfer  Check payable to POLYMAT

Payment by credit card is not accepted.

Emulsion polymers are truly "products by process" materials, whose properties are determined during the polymerization process. The course will focus on the understanding of the fundamental basis of emulsion polymerization and on the use of this understanding to manipulate process conditions to achieve a consistent production of improved products. The fundamentals of latex rheology, film formation and adhesion of polymers, key aspects in the application of emulsion polymers, will also be studied.

**For more information, to register or to request another printed copy of the brochure, please contact:**

**Ms. Inés Plaza**

POLYMAT, Joxe Mari Korta Center

University of the Basque Country, UPV/EHU

Donostia-San Sebastián, 20018, SPAIN

Phone: +34-943-018462

Fax: +34-943-017065

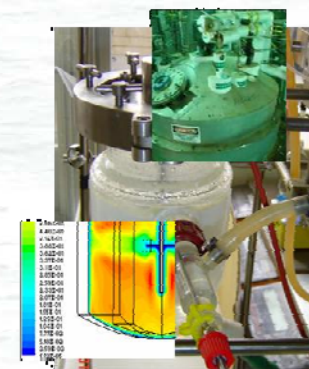
E-mail: [eppcourse@ehu.es](mailto:eppcourse@ehu.es)

**Or visit our web site (including on-line registration):**

<http://www.ehu.eus/en/web/polymat/epp-course>

# Course on EMULSION POLYMERIZATION PROCESSES

September 7-11, 2015



Universidad del País Vasco Euskal Herriko Unibertsitatea

# POLYMAT



## PROGRAM AND COURSE OUTLINE

**Monday, September 7, 2015**

**13.30-14.30 Registration**

**14.30-16.30 Features of Emulsion Polymerization (Prof. José M. Asua, POLYMAT)**

Processes occurring in emulsion polymerization. Similarities and differences with other polymerization techniques in dispersed media (miniemulsion, microemulsion and dispersion polymerization). Reactors. Applications of polymer dispersions.

**16.30- 17.00 Coffee Break**

**17.00-18.00 Seminar on kinetic measurements (Prof. María J. Barandiaran, POLYMAT)**

How to run an experiment. Determination of kinetic measurements from experiments.

**Tuesday, September 8, 2015**

**8.30-10.30 Kinetics of Emulsion Polymerization (Prof. José M. Asua, POLYMAT)**

Factors affecting polymerization rate. Radical entry: processes involved; effects of water solubility of monomers and initiators, characteristics of the surface of the polymer particles. Radicals exit: processes involved; factors affecting radical exit (water solubility of monomers and initiators, particle size, characteristics of the surface of the polymer particles). Radical termination. Average number of radicals/particle. Monomer partitioning: thermodynamically controlled systems; mass transfer limitations.

**10.30-11.00 Coffee Break**

**11.00-13.00 Stability of Polymer Colloids (Prof. José M. Asua, POLYMAT)**

Colloidal stability. Mechanisms affecting dispersion stability. Electrostatic stabilization. Overcharging. Steric stabilization. Total potential energy of interaction. Flocculation of systems sterically stabilized. Electrosteric stabilization. Aggregation kinetics.

**13.00-14.30 Lunch**

**14.30-15.30 Particle Nucleation and Particle Size Distribution (Prof. María J. Barandiaran, POLYMAT)**

Description of the mechanisms for particle nucleation. Particle size distribution. Effect of the formulation and process conditions.

**15.30-16.30 Particle Morphology (Prof. José M. Asua, POLYMAT)**

Thermodynamic and kinetic aspects for particle morphology control.

**16.30-17.00 Coffee Break**

**17.00-18.00 Visit to POLYMAT laboratories**

**21.00 Conference dinner**

**Wednesday, September 9, 2015**

**9.00-11.00 Molecular Weight Distribution (Prof. José R. Leiza, POLYMAT)**

Introduction. MWD in linear polymerization: Rigorous modelling compartmentalization, MWD for a 0-1 system. MWD in non-linear systems: computation of sol MWD and gel content. Numerical and experimental examples.

**11.00-11.30 Coffee Break**

**11.30-13.30 Advanced Research Topics: Bases and Applications of CFRP in Dispersed Media (Dr. Franck D'Agosto. CNRS, Laboratoire de Chimie et Procédés de Polymérisation)**

Bases and applications of controlled/living radical polymerisations (CFRP) carried out in the presence of water. Challenges for adapting CFRP to water dispersions. Emphasis on future opportunities and open issues.

**13.30-15.00 Lunch**

**15.00-16.00 Miniemulsion Polymerization (Prof. José M. Asua, POLYMAT)**

Scientific basis for the preparation of monomer miniemulsions: homogenization; thermodynamic and kinetic stabilization. Effect of preparation conditions and of the miniemulsion formulation on the polymerization. Applications.

**16.00-17.00 Latex Rheology (Prof. José M. Asua, POLYMAT)**

Key aspects affecting the viscosity of waterborne polymer dispersions. Equations for dispersion viscosity Thickeners.

**17.00-17.30 Coffee Break**

**17.30-18.30 Seminar on Latex Characterization (Prof. José R. Leiza, POLYMAT)**

Copolymer composition. Molecular weight distribution. Gel content.

**Thursday, September 10, 2015**

**9.00-10.30 Emulsion Polymerization Reactors (I) (Prof. María Paulis, POLYMAT)**

Reactor types. Reactor equipment for mixing. Power consumption. Agitation requirements for emulsion polymerization. Mass transfer limitations. Heat transfer. Predicting the performance of emulsion polymerization reactors: Mass, energy and population balances. Evolution of characteristics in the different operation modes.

**10.30-11.00 Coffee Break**

**11.00-12.00 Emulsion Polymerization Reactors (II) (Prof. María Paulis, POLYMAT)**

Determination of safety parameters. Scale up. Residual monomer removal: devolatilization and postpolymerization.

**12.00-13.00 On-line Monitoring (Prof. José R. Leiza, POLYMAT)**

Sensor selection. Latex gas chromatography. Head-Space gas chromatography. Densimetry. Ultrasound. Spectroscopic techniques. Reaction calorimetry. Raman vs calorimetry. Experimental results.

**13.00-14.30 Lunch**

**14.30-15.30 Control of Emulsion Polymerization Reactors (Prof. José R. Leiza, POLYMAT)**

Open-loop and close-loop strategies. Close-loop for linear polymers: Optimal trajectories; Examples of safe optimal control of composition and MWD; Final property control. Unsolved issues in closed-loop control.

**15.30-16.00 Coffee Break**

**16.00-18.00 Waterborne polymer/inorganic hybrids (Prof. E. Bourgeat-Lami, CNRS, Laboratoire de Chimie et Procédés de Polymérisation)**

Overview of the basic principles and main synthetic procedures involved in the synthesis of organic/inorganic colloid through heterophase polymerization. Recent advances on the control of particles morphology and polymerization kinetics. Typical examples including the incorporation of titanium dioxide, silica, magnetic particles and clay colloids into polymer particles.

**Friday, September 11, 2015**

**8.30-10.30 Film Formation of Waterborne Coatings (Prof. María Paulis, POLYMAT)**

Stages of film formation: drying, particle deformation and interdiffusion. Fundamental driving forces for particle coalescence. Introduction to key analytical techniques and review of experimental results.

**10.30-11.00 Coffee Break**

**11.00-13.00 Biomedical Applications of Polymer Colloids. (Dr. José Ramos, Imperial College London).**

Requirements for the bionanoparticles: Basic concepts. Hard Nanoparticles: Functionalized and Hybrid Latexes. Soft Nanoparticles: Stimuli-Responsive Nanogels. Advanced Biomedical Applications.

**13.00 End of the course.**

## PARTICIPANTS

The course is designed for scientists and engineers from industry and academia actively interested in emulsion polymerization. English will be the official language of the course.

## ATTENDANCE MODALITY

Personal in-site attendance

## LOCATION AND TRANSPORT FACILITIES

The course will take place in Joxe Mari Korta Building in The University of the Basque Country Campus in Donostia-San Sebastián. It is easily accessible by plane via the Donostia-San Sebastián Airport (30 minutes away by taxi), Bilbao airport (60 minutes away by taxi) and Biarritz Airport (in France, 40 minutes away by taxi).

## ACCOMODATION

A limited number of rooms has been blocked at special rates, in a hotel and a residence near the course location. Modern single rooms in the Olarain university residence are available at a rate of 56.40 € single room and 67.50 € double room breakfast included (plus 10% tax). The four stars Hotel NH Aranzazu offers rooms at a rate of 75.00 € single room and 127.73 € double room breakfast included (plus 10% tax). Rates in both cases include a buffet breakfast. Each participant should arrange directly his reservation and will be charged by the hotel for room costs and extras. Please note that availability and price of these rooms are guaranteed until the 1st of June.

## COURSE FEES

The course fee is 1,350 € for in-site attendants (free of transfer charges) and covers attendance, course notes and conference dinner. Company members of the Industrial Liaison Program in Polymerization in Dispersed Media may register two people free of charge. Additional personnel from these companies may also register at half of the regular fee.

## PAYMENT METHOD

The payment of the course fee can be made by a check payable to "POLYMAT-Ingeniería Instituto Materiales Poliméricos", or by bank transfers to **IBAN: ES65 2095 0292 9010 6157 2763** (Bank: "KUTXABANK", C/Maestro Guridi, 13, 20008 Donostia-San Sebastián, Spain) with the SWIFT code: **BASKES2BXXX**. If this second choice is used, please reference your name and the full name of your company and fax a copy of the bank transfer papers to us.