



# Laboratory of FORMULATION, INTERFACES, RHEOLOGY and PROCESSES

## F.I.R.P.

School of Chemical Engineering  
University of Los Andes  
Mérida - Venezuela

## LABORATORY FIRP

### FORMULATION, INTERFACES, RHEOLOGY & PROCESSES

School of Chemical Engineering,  
University of Los Andes (ULA)  
Mérida - Venezuela  
[www.firp.ula.ve](http://www.firp.ula.ve)

**Laboratory FIRP** is actually an association of over 20 faculty members of ULA from Engineering, Chemistry and Pharmacy Colleges, who carry out research and development activities as well as teaching and consulting in areas such as **Physico-chemical Formulation, Surfactant Science, Micro and Macro-emulsions, Foams, Dispersed Systems, Rheology, and Transport**. One third of the faculty has some industrial work experience. Applied research activities cover a wide range of business such as petroleum and petrochemicals, detergents, cosmetics and pharmaceuticals, foods, paints and varnishes...

Also associated to Laboratory **FIRP** are 20 young researchers (5th year undergraduate trainees and graduate students), a few postdoctoral fellows and visiting scholars and a 5 member staff. FIRP laboratory is organized in groups according to the scope of the research or as ad-hoc teams matching the contracted R&D activities.

**Laboratory FIRP** belongs to national and international networks including academic and industrial centers, whose know-how is complementary to our, so that synergistic performances could be generated in research, development, problem-solving services, continuous education and training.

**Laboratory FIRP** is the largest association of scientists and engineers in surfactant science, interfacial phenomena, suspensions, emulsions and foams in Latin America, and one of the well recognized applied research center worldwide

## ACTIVITIES

### RESEARCH

Fundamental and applied investigations are carried out on surfactant-oil-water systems phase behavior, emulsion and foam properties related to formulation, emulsion formation and inversion mechanisms, formulation of complex systems involving surfactant mixtures, polymers, lignin derivatives, extended surfactants, pH-sensitive or temperature-sensitive systems etc...

A part of this research is sponsored by the Venezuelan Ministry of Science and Technology through **FONACIT**, whereas other is subsidized by the university Research Council CDCHT, and by international agencies.

### DEVELOPMENT and SERVICES

Applied research is carried out in the framework of confidential contracts on topics such as solubilization in microemulsions, "green" formulation for remediation in different areas, systems which are insensitive to temperature, cutting oils, self-emulsifying concentrates, stabilization or breaking of emulsions containing solid particles, emulsion phase inversion to produce nanoemulsions, drilling fluids, laminating fluids, crude oil demulsification and desalting, asphalt emulsions, aqueous and non-aqueous foams, foam properties at high pressure and high temperature, cosmetic and pharmaceutical applications, fuel emulsions ...

### FORMATION and TRAINING

**FIRP** researchers offer annually a dozen of continuous education courses and know-how trainings on Surfactants and Applications, Formulation and Properties of Micro and Macroemulsions, Foams, Drilling Fluids, Rheology of Complex Fluids, Membrane Separation Processes. Mixing and Stirring, as well as "a la carte" in-house formations.

In the past 10 years these courses and trainings have been given over 150 times in Spanish, English, French and Italian in Venezuela, and abroad, e. g. in Brazil, Colombia, Mexico, USA, France, Sweden, Germany, UK, Italy and Belgium.

Laboratory FIRP receives undergraduate and graduate students from other national and foreign universities thanks to various exchange programs.

Long (up to 5 month) expertise-building programs are offered "a la carte" for industrial partner companies wanting to develop the know-how of their formulators. In the past 2 years over 20 people from partner industries have been enrolled in custom-made know-how training periods extending from 2 weeks to 5 months.

## DIVULGATION

Laboratory FIRP associates have published 20 chapters in textbooks, encyclopedias, and handbooks, as well as over 200 research papers in international scientific journals. A collection of technical leaflets is offered as teaching aid on a variety of topics in Spanish (Cuadernos FIRP) and will be soon available in English and French.

## TECHNICAL SERVICES and COUNSELLING

Confidential agreements and contracts to carry out research, development, technical service and counselling activities are the basis of a very strong partnership with companies such as **PDVSA, INTEVEP, PECHINEY, LAFARGE, COGNIS, IFP, SCHLUMBERGER, BAKER-HUGHES DRILLING FLUIDS, PROCTER & GAMBLE, LIPESA, BASF, ELF-AQUITAINE, QUIDECO, CLARIANT, RHODIA, ENITECNOLOGIE, AKZO-NOBEL, UNILEVER, RESINAS MULTIPLES, PLUSPETROL, CHAMPION, VALLÉE** etc ... in Venezuela and worldwide.

## SCIENTIFIC EQUIPMENTS

Laboratory FIRP associates and industrial partners have access to a wide set of surface analysis instruments:

- Particle analyzer Mastersizer Malvern (200 -1  $\mu\text{m}$ )
- Particle analyzer Coulter-Beckman LP130 ( $\geq 50\text{nm}$ )
- Particle analyzer Beckman N5 (3 nm -3  $\mu\text{m}$ )
- Langmuir Balance - Lauda
- Ribbon distillation column
- Microbalance Cahn
- Video Microscope Nikon
- Various Viscosimeters (falling ball, Ostwald, Ependorff, Brookfield, Rheomat)
- Constant shear Rheometers Rheometrics 5000
- Spinning drop Tensiometers
- Whilhelmy and De Nouy Tensiometers
- Pendant drop tensiometer KSV
- Turbiscan back scattering nephelometer Formulation
- Zetameter Coulter-Beckman Delsa
- Calorimetric Analyzer
- HPLC/HPSEC/GC Chromatographs
- UV-Vis and AA spectrometers

## PILOT PLANTS

- Laboratory FIRP has built various lab scale pilot plants.
- Pilot plant (1-2 Ton/h) for asphalt, bitumen and heavy hydrocarbon emulsification
  - Pilot plant for computer-controlled emulsion inversion.
  - In-line Viscometer to test rheological behavior of complex fluids, emulsions and foams

## ASSOCIATED LABORATORIES

Laboratory **FIRP** activities are matched with R&D in other academic and industrial research centers in Venezuela and abroad, with which researchers and students are exchanged: Lab. de Mezclado, Separación por Membranas y Síntesis Industrial (**LMMSI - ULA**), Lab. de Polímeros y Coloides (**POLYCOL-ULA**), Lab. de Bioquímica Adaptativa (Medicina-ULA) Instituto de Investigaciones de la Facultad de Farmacia (**IIF-ULA**), Centro de Innovación Tecnológica (**CITEC-ULA**), Lab. de Petroquímica y Surfactantes (**LPS-LUZ**), Lab. de Sistemas Dispersados y Ambiente (**SDA-UDO**), Centre de Génie Chimique des Milieux Rhéologiquement Complexes (**GEMICO-Nancy-Francia**), Lab. Fluides Complexes (**LFC-UPPA-Pau-Francia**), Ytkemiska Institutet (**YKI-KTH Stockholm - Suecia**), Institute for Applied Surfactant Research (**IASR-Norman-USA**), Institut Français du Pétrole (**IFP - Paris - Francia**), Forest Biomaterial Lab, North Carolina State University (**Raleigh - USA**), Institut Européen de Membranes (**USTL-Montpellier-Francia**), **CID-CSIC** en tensioactivos (**Barcelona-España**), Lab. d'Oxydation et Formulation (**USTL-Lille-Francia**), Lab. de Génie Chimique - Groupe Agitation/Mélange (**ENSIACET - INP Toulouse - France**), Surface Laboratory Univ. de Florida (**Gainesville - USA**) among others.

## SCIENTIFIC INSTRUMENTS DEVELOPED WITH CITEC-ULA

### SPINNING DROP TENSIO METER:

To measure ultralow interfacial tension between two liquids down to 0.0001 mN/m. *Available for sale.*



### FALLING BALL RHEOMETER:

Inexpensive instrument to control the viscosity of drilling fluids, paints, foams ....

### LABORATORY ELECTROSTATIC DEHYDRATOR:

To rapidly test demulsifier formulations, particularly for crude oil dehydration. *Available for sale.*



### HIGH PRESSURE HIGH TEMPERATURE FOAM METER:

To evaluate foam stability up to 140 °C and 200 atm.

## INFORMATION and CONTACTS

Ph: ++58(0\*)274-2402954/(0\*)274-2402815

Fax (0\*)274-2402957

Web page

<http://www.firp.ula.ve>

Emails

[firp@ula.ve](mailto:firp@ula.ve) (secretaría)

[jbullon@ula.ve](mailto:jbullon@ula.ve) (Johnny Bullón, Director)

[salager@ula.ve](mailto:salager@ula.ve) (Jean-Louis Salager, Dep. Director)

[aurag@ula.ve](mailto:aurag@ula.ve) (Ms. Evalu Garcia, Executive Secretary)

\* *Do not dial (0) when calling from outside Venezuela*

V # 2.0 March 2007



Formulation, Interfaces, Rheology & Processes

**UNIVERSIDAD DE LOS ANDES  
MÉRIDA - VENEZUELA**