Summer School of Calorimetry 2011
" Calorimetry and thermal methods in catalysis "

19 - 24 juin 2011

Calorimetry and thermal analysis methods, alone or linked to other techniques, applied to the characterization of catalysts, supports and adsorbents, and to the study of catalytic reactions in various domains: air and wastewater treatment, clean and renewable energies, refining of hydrocarbons, green chemistry, hydrogen production and storage, CO_2 capture…

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Dates. June 19 (welcome around 16h-17h) – June 24 (end around 16h-17h), 2011.
Inscription.
See our website: **http://calo.catalyse.cnrs.fr**
Please register on line (opening around February 10, 2011)
Location. The school will be held on the beautiful site of Fourvière Hill in Lyon, close to the Basilique de Fourvière, 69005 Lyon, France (historic center of Lyon)
Rooms in CNFETP: Single rooms, but with shared shower and toilets for 4 rooms, (double rooms on request) will be available in CNFETP center, 9 montée Nicolas de Lange, 69005 Lyon, France. Single (double rooms on request) with individual shower and toilets will be also available in Jean Bosco center, 200m from CNFETP, 14 rue Roger Radisson, 69005 Lyon. A list of low price hotels will also be available on request.(see the list on the website)

Registration fee. The registration fee includes lodging in CNFETP or Jean Bosco centers, breakfasts, lunches and diners , coffees and drinks, welcome party, excursion and banquet, book of lessons.
- participants belonging to CNRS (**permanent people only**): free of charge
- participants from other public or private organisations including post-doctorants: 750 € with lodging in Jean Bosco center (500 € without lodging)
- students and PhD students: 500 € with lodging in CNFETP (750 € with lodging in Jean Bosco) and 350 € without lodging.

For further information and reservation, please contact:
Dr. Aline AUROUX, aline.auroux@ircelyon.univ-lyon1.fr

Participants. The school is addressed to PhD students, Post-docs, researchers, engineers, technical staff and technologists, belonging to academic structures as well as to private companies, already working or interested to orient their future research in the field of thermal analysis techniques and calorimetry, and which wish to acquire skill in such methods applied to the characterization of solid supports and catalysts and to the catalytic reactions studies. English-speaking participants are welcome (lessons will be given both in French and in English in two parallel sessions).

Purpose of the Course. The course is intended to fill the gap between the basic thermodynamic and kinetics concepts acquired by the students during their academic formation, and the use of experimental techniques such as thermal analysis and calorimetry to answer practical questions. The course will give the students insight into the different thermal and calorimetric methods which can be employed in studies aimed at characterizing the physico-chemical properties of solid adsorbents, supports and catalysts, and the processes related to the adsorption – desorption phenomena of the reactants and/or products of catalytic reactions. The course will give also the basic concepts for the

physico-chemical comprehension of the relevant phenomena. Thermodynamic and kinetic aspects of the catalytic reactions can be fruitfully investigated by means of thermal analysis and calorimetric methods, in order to better understand the sequence of the elemental steps in the catalysed reaction. The fundamental theory behind the various thermal analysis and calorimetric techniques and methods will be also illustrated.

OUTLINE OF THE SUBJECTS (CONTENT OF THE COURSES AND TD):

I. Basic thermodynamics concepts in thermal effects

- Thermodynamics of the adsorption
- Kinetics of catalytic reactions

II. Calorimetric and Thermal Analysis techniques:

1) calorimetry, DSC (differential scanning calorimetry), TGA (thermogravimetric analysis), DTA (differential thermal analysis), TPD (thermoprogrammed desoption), TPR/TPO (thermoprogrammed reduction/oxidation), Inverse Gas Chromatography.

2) coupled techniques:

In gas phase:

Calorimetry – Volumetry, TG – DSC- MS, DSC –GPChromatography

In liquid phase:

Calorimetry – UV / Visible spectroscopy, Calorimetry –– HPLChromatography, Titration and flow calorimetry

3) Calorimetric cells

III. Calibration Methods

IV. Advantages, limitations and practical aspects of the different thermal analysis methods

V. Applications to the study of solid materials

1) Solid -gas and solid-liquid interactions at the interface with solid catalysts:

-Characterization of acidic / basic sites (oxides, zeolites, activated carbons,…)

-Characterization of redox and metallic site

-Hydrophilic/hydrophobic features

-Adsorption and capture of pollutants (NO_x, CO_x, COV, PAH,...)

-Selective adsorption of gas mixtures in porous materials

-Selective and competitive adsorptions from solution

2°) Case study: hydrogen storage and production (metal hydrides, catalytic reforming, fuel cells,…), CO_2 capture.

TEACHING FACILITIES

- Lectures (Power Point slides)
- Hands-on (small groups of students)
- Demonstrations by using apparatus on site or in labs in Lyon and movies.
- Round tables
- Posters presentation by the participants (not obligatory)
- Guided visits to calorimetry and thermal analysis laboratories in Lyon
- Distribution of a hard copy of the teaching material
- Creation of a web-site as an interactive platform, aimed at allowing the participants to ask questions and communicate each other (for a period of 3-6 months after the end of the School)

KEY-WORDS: CALORIMETRY, THERMAL ANALYSIS, CATALYSIS, CATALYSTS, ADSORBENTS, ADSORPTION, THERMODYNAMICS, REACTION KINETICS, PHYSICAL-CHEMISTRY OF THE INTERFACES, CHEMICAL REACTIONS

PROGRAMME: A more detailed programme will be soon available on the website: **http://calo.catalyse.cnrs.fr**(Photos of the calorimetry school which was held in june 2010 can still be seen on **http://calo.catalyse.cnrs.fr/** (2010)

TEACHERS: 10 teachers from France and various European countries among the most well known specialists in calorimetry and thermal analysis techniques, speaking fluently both French and English, will give lessons and advices during the school.

Lessons will be given in parallel sessions (in 2 different rooms) in French and in English.