TÉCNICO LISBOA

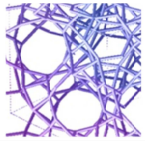
Symposium in Honour of Ramôa Ribeiro

PROGRAMME

CATALYSIS: FROM THE ACTIVE SITE TO THE PROCESS

Instituto Superior Técnico
Salão Nobre – Pavilhão Central
8th - 9th October 2012

SYMPOSIUM IN HONOUR OF FERNANDO RAMÔA RIBEIRO – DETAILED SCIENTIFIC PROGRAMME



Monday, October 8th

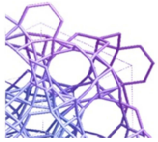
8:00-18:00h Registration

9:00-9:30h	9:30-10:00h	10:00-10:30h	10:30-11:00h	COFFEE BREAK	11:30-12:10h	12:10-12:30h	12:30-12:50h
	Chairs: C. Marcilly and J. Védrine				Chairs: J. Lázaro and F. Thibault-Starzyk		
OPENING CEREMONY	**KN1** **M. Guisnet** Univ. Poitiers France	**KN2** **J.L. Figueiredo** FEUP, Porto Portugal	**KN3** **M. Che** UPMC, Paris France		**PL1** **A. Corma** ITQ, Valencia Spain	**O1** **J.P. Gilson** Univ. Caen France	**O2** **P. Massiani** UPMC, Paris France

12h50-14h20 LUNCH - POSTERS SESSION

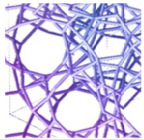
14:20-15:00h	15:00-15:30h	15:30-15:50h	COFFEE BREAK	16:20-16:40h	16:40-17:00h	17:00-17:20h	17:20-17:40h	17:40-18:00h
Chairs: C. Travers and C.A. Henriques				Chairs: C.C. Romão and R.M. Martín-Aranda				
PL2 **J. Martens** KU Leuven Belgium	**KN4** **F. Fajula** Inst. Charles Gerhardt, Montpellier France	**O3** **H. Cerqueira** OSX Brazil		**O4** **L. Pinard** Univ. Poitiers France	**O5** **A. Pombeiro** IST, Lisboa Portugal	**O6** **Z. Gabelica** Univ. Mulhouse France	**O7** **I. Ivanova** Moscow State Univ. Russia	**O8** **J. Halász** Univ. Szeged Hungary

INFORMAL DINNER – Transfers provided from the Symposium Venue



Plenary lecture – 40 min	KeyNote lecture– 30 min	Oral presentation – 15 min + 5 min discussion

SYMPOSIUM IN HONOUR OF FERNANDO RAMÔA RIBEIRO – DETAILED SCIENTIFIC PROGRAMME



Tuesday, October 9th

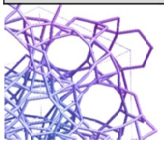
8:00-16:00h Registration

9:00-9:40h	9:40-10:10h	10:10-10:30h	10:30-10:50h	COFFEE BREAK	11:20-11:50h	11:50-12:10h	12:10-12:30h	12:30-12:50h
Chairs: C. Fernandez and Y. Pouilloux					Chairs: A. Kiennemann and P. Ávila			
PL3	**KN5**	**O9**	**O10**		**KN6**	**O11**	**O12**	**O13**
P. Beato	**J. Rocha**	**M. Carrot**	**E. Garrone**		**Z. Sobalík**	**M. Pereira**	**F. Maldonado**	**G. Giordano**
Haldor Topsoe Denmark	Univ. Aveiro Portugal	Univ. Évora Portugal	Pol. Torino, Turin Italy		J. Heyrovský, IPC, Prague Czech Republic	Univ. Coimbra Portugal	Univ. Granada Spain	Univ. Calabria Italy

12h50-14h20 LUNCH - POSTERS SESSION

14:20-15:00h	15:00-15:30h	15:30-15:50h	COFFEE BREAK	16:20-16:40h	16:40-17:00h	17:00-17:20	17:20-17:40h
Chairs: J.P. Marques and J.B. Nagy				Chairs: G. Djéga-Mariadassou and J. Faria			
PL4	**KN7**	**O14**		**KN8**	**O15**	**O16**	**O17**
J.F. Joly	**E. Falabella**	**A. Rodrigues**		**S. Capela, P. Da Costa**	**E. Guillon**	**P. Araújo**	**G. Caeiro**
IFP Energies Nouvelles France	Petrobras Brazil	FEUP, Porto Portugal		GDF-Suez, UPMC France	IFP Energies Nouvelles France	CUF Portugal	Galp Energia Portugal

CLOSING REMARKS – J. VEDRINE, UNIVERSITE PIERRE ET MARIE CURIE, FRANCE



Plenary lecture – 40 min | KeyNote lecture– 30 min | Oral presentation – 15 min + 5 min discussion

Welcome to SCRR 2012

It is our great pleasure to welcome all participants to the Symposium Catalysis: From the Active Site to the Process, organised in memory of Professor Fernando Ramôa Ribeiro.

Ramôa Ribeiro died on August 29th 2011. He was born on October 4th 1945 and obtained his graduation on Industrial Chemical Engineering at the Engineering Faculty of the University of Porto (1968) and a Doctorat d'Etat (Heterogeneous Catalysis) by Université de Poitiers in France (1980). His PhD, carried out at Institut Français du Pétrole in collaboration with the University of Poitiers, was supervised by M. Guisnet and Ch. Marcilly.

Since then, as Professor at Instituto Superior Técnico (IST), Ramôa Ribeiro developed the area of Heterogeneous Catalysis, in particular the area of Catalysis by Zeolites, creating the research group in Catalysis and Reaction Engineering (CRERG). His research interests led him to develop a variety of contacts and collaborations worldwide but with a particular emphasis on research groups in France, the country where he obtained his PhD and with which he always had a particular connection and which granted him a series of commendations by the French Government, namely "Officier des Palmes Académiques" and "Chevalier de l'Ordre National du Mérite", both in 1993 and "Officier de l'Ordre National du Mérite" in 1998.

To carry out this scientific Symposium, the Ambassade de France, together with many friends from several countries, agreed to join us in this tribute in recognition of his great contribution to the scientific and the academic communities. In this two-days scientific event, we are pleased to count on the presence of invited researchers that will ensure 4 plenary lectures, 8 keynotes and 17 oral communications. Moreover, from the call for submission of posters, about 60 abstracts were selected and accepted for posters contribution.

All authors of plenary lectures, keynotes and orals are invited to submit full manuscripts for publication in Elsevier's Catalysis Today journal whose editors accepted to publish a special issue in memory of Professor Ribeiro. The authors of 3 selected poster communications will be also invited to submit their contributions for this special issue.

Finally, we are very grateful to all persons, companies and entities that made possible this scientific meeting to take place and hope all of you will enjoy the Symposium programme and will engage into fruitful scientific discussions.

The Organising Committee

Honour Committee

Professor Dr. Nuno Crato, Minister of Education and Science
Professor Dr. Adriano Moreira, Technical University of Lisbon
General Council President
Professor Dr. António Cruz Serra, Technical University of Lisbon
Rector
Ambassador Pascal Teixeira da Silva, Ambassador of France
Professor Dr. Arlindo Oliveira, IST President
Professor Dr. Ricardo Vieiralves, Rio de Janeiro State University Rector
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Local Secretary

Rita Maia
Contact: simpcatrr@gmail.com
Tel: (00351)218417872
Fax: (00351)218419198

GENERAL INFORMATION

Lisbon

Lisbon is one of the European greatest historical cities with wonderful and surprising sights, cultural treasures and a beautiful setting that makes it a perfect place for visitors, walkers and photographers. Lisbon is relatively close from all the other important cities of Europe. Its location near the sea allows an almost constant presence of sunshine that transforms, together with the Tagus River, the Portuguese capital into a mirror of a thousand colours - highlighting the city's unique architecture and beauty. Lisbon has got a very mild climate along all the year making it a perfect year-round destination, with many things to see and many different experiences to live. As we walk through Lisbon we can find streets filled with heritage monuments, like S. Jorge castle, S. Justa elevator, Carmo convent and Sé church, and charming medieval village-like neighbourhoods, where the city was firstly developed and where it can still be experienced at its most genuine level. For example, Lisbon presents a very beautiful tram network, which allows a wonderful ride over traditional neighbourhoods on old-fashioned yellow trams. In sum, Lisbon is a peaceful and friendly place with an insatiable appetite for long dinners, coffee breaks and nightlife.

Symposium venue

Instituto Superior Técnico, Salão Nobre – Pavilhão Central, Avenida Rovisco Pais, 1, 1049-001 Lisboa, Portugal. Tel: (+351) 218417872; Fax: (+351) 218419198; Email: simpcatrr@gmail.com (Secretary Rita Maia).

Registration desk

Registration desks will be located at Instituto Superior Técnico, Salão Nobre – Pavilhão Central. Information concerning scientific symposium, registration, posters sessions and social events will be available there. The registration desk will be open on October 8th and 9th from 8:00 to 18:00 h.

Certificate of attendance and payment receipt can be asked at the registration desk.

Registration fee includes:

attendance to all scientific and poster sessions - entrance to the exhibition area
badge and congress kit - coffee breaks - 2 lunch tickets

SYMPOSIUM TECHNICAL INFORMATION

Instructions for oral presentations

Time of lecture

- Plenary lecture: 40 min (no questions)
- Keynote lecture: 30 min (no questions)
- Orals : 15 min + 5 min questions

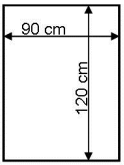
Chairpersons

The chairpersons are kindly asked to strictly follow time schedule.

Poster sessions: October 8th and 9th, from 12:50 to 14:20 h (lunch time).

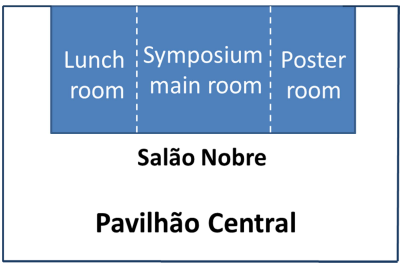
All the posters must be put up on Monday, October 8th, from 8:00 to 9:00 h, and removed by the end of the Symposium. The material to put up the posters will be provided by the Symposium Staff.

Poster board:



Lunches and coffee breaks

Two lunch tickets will be available in the registration kit for the participants of the Symposium.



Official language

The official language of the Symposium is English, except during Monday morning where the first part of the scientific session will be simultaneously translated in French and Portuguese with the support of the Institut Français au Portugal (IFP).

Badges and security

It is important that you wear your personal badge during all the Symposium and also during the Social dinner.

SOCIAL EVENT

The Symposium Dinner on Monday 8th of October will take place in a traditional restaurant called "Páteo de Alfama", located in one of the oldest Lisbon's neighbourhoods, Alfama. You will be able to enjoy and taste Portugal's rich culture including our world famous cuisine mixed with true Portuguese Heritage, Folklore dance and Fado… Transfers will be provided.

Dinner fee: 40 euros (VAT included) – Payment: only by cash at the Symposium registration desk on Monday 8th October, for those who have confirmed previously.

SUPPORTERS

Associazione Italiana Zeoliti

British Zeolite Association

Division Catalyse - Société de Chimie de France

European Federation of Catalysis Societies

Federation of European Zeolite Association

Groupe Français des Zéolithes

International Zeolite Association

Ordem dos Engenheiros

Sociedade IberoAmericana de Catálise

Sociedade Portuguesa de Química

Turismo de Lisboa

Hotel AS LISBOA

DETAILED SCIENTIFIC PROGRAMME

Note: the complete version of the book of abstracts with all plenary, keynote, oral presentations and poster abstracts is available in the USB key.

MONDAY 8 - morning

8h00-18h00		REGISTRATION
9h00-9h30		OPENING CEREMONY
		Chairs: C. Marcilly and J. Védrine
9h30-10h00	KN1	Catalysis over bifunctional redox acid zeolites. A route to cleaner processes, M. Guisnet, Univ. Poitiers, France.
10h00-10h30	KN2	Carbon as a catalyst, J. L. Figueiredo, FEUP, Porto, Portugal.
10h30-11h00	KN3	1912 Nobel Prize in Chemistry awarded to Sabatier: organic chemistry or catalysis?, M. Che, UPMC, Paris, France
11h00-11h30		COFFEE BREAK sponsored by paralab
		Chairs: J. Lázaro and F. Thibault-Starzyk
11h30-12h10	PL1	New challenges in FCC for processing heavy crudes, A. Corma, ITQ, Valencia, Spain.
12h10-12h30	O1	Control of secondary porosity in zeolite materials by bottom-up and top-down methodologies: preparation, characterization and catalysts testing, J.P. Gilson, Univ. Caen, France.
12h30-12h50	O2	In situ TEM and XAS monitoring of the stability of dispersed cationic Ag on FAU and alumina supports, P. Massiani, UPMC, Paris, France.
12h50-14h20		LUNCH – POSTERS SESSION

MONDAY 8 – afternoon

		Chairs: C. Travers and C.A. Henriques
14h20-15h00	PL2	Impact of the shift from fossil to renewable hydrocarbon feedstock on design of hydrocracking catalysts, J. Martens, KU Leuven, Belgium.
15h00-15h30	KN4	Flow-through silica monoliths with multimodal hierarchical porosity for catalytic and separation liquid-phase processes intensification, F. Fajula, Institut Charles Gerhardt, Montpellier, France.
15h30-15h50	O3	Deactivation of zeolite catalysts under FCC conditions, H. Cerqueira, OSX, Brazil.
15h50-16h20		COFFEE BREAK sponsored by paralab
		Chairs: C.C. Romão and R.M. Martín-Aranda
16h20-16h40	O4	Radicalar coke as active species in ethanol transformation into hydrocarbons, L. Pinard, Univ. Poitiers, France.
16h40-17h00	O5	Can alkanes become feedstocks for organic synthesis?, A. Pombeiro, IST, Lisboa, Portugal.
17h00-17h20	O6	CuIST-2 (AEN), a novel CuAPO with unusual framework Cu(II) and Cu(I) coordination: one pot synthesis and copper characterization, Z. Gabelica, Univ. Mulhouse, France.
17h20-17h40	O7	New routes of acetone conversion into valuable products, I. Ivanova, Moscow State Univ., Russia.
17h40-18h00	O8	Hydrogenation of light unsaturated nitriles over Pt and Rh nanoparticles supported on mesoporous materials, J. Halasz, Univ. Szeged, Hungary.
20h30-		INFORMAL DINNER

TUESDAY 9 - morning

8h00-16h00		REGISTRATION
		Chairs: C. Fernandez and Y. Pouilloux
9h00-9h40	PL3	Conversion of methanol to hydrocarbons: How zeolite cavity and pore size controls product selectivity, P. Beato, Haldor Topsøe, Denmark.
9h40-10h10	KN5	Microporous materials: beyond catalysis, J. Rocha, Univ. Aveiro, Portugal.
10h10-10h30	O9	Porosity of acid activated Porto Santo bentonites assessed by n-nonane pre-adsorption and nitrogen adsorption, M. Carrot, Univ. Évora, Portugal.
10h30-10h50	O10	Surface properties of single-walled silico-aluminate nanotubes, E. Garrone, Politec. Torino, Turin, Italy.
10h50-11h20		COFFEE BREAK sponsored by paralab
		Chairs: A. Kiennemann and P. Ávila
11h20-11h50	KN6	Role of Al distribution in optimization of the performance of metallo-zeolites for DeNOx processes, Z. Sobalik, J. Heyrovský, IPC, Prague, Czech Republic.
11h50-12h10	O11	Immobilization of metal complexes onto solid supports: homogeneous versus heterogeneized catalyst, M. Pereira, Univ. Coimbra, Portugal.
12h10-12h30	O12	Controlling the nanostructure of metal-doped carbon gels for catalytic applications, F. Maldonado, Univ. Granada, Spain.
12h30-12h50	O13	Effect of zeolite silylation and delamination on the methane dry reforming reaction, G. Giordano, Univ. Calabria, Italy.
12h50-14h20		LUNCH – POSTERS SESSION

TUESDAY 9 - afternoon

		Chairs: J.P. Marques and J.B. Nagy
14h20-15h00	PL4	From laboratory research to foundations of process industrialization, J. F. Joly, IFP Energies Nouvelles, Lyon, France.
15h00-15h30	KN7	The influence of rare earth elements on the activity and selectivity of zeolites and FCC catalysts, E. Falabella, Petrobras, Brazil.
15h30-15h50	O14	Process Intensification: new technologies (SMBR and PermSMBR) for the synthesis of acetals, A. Rodrigues, FEUP, Porto, Portugal.
15h50-16h20	COFFEE BREAK sponsored by paralab IBEROL	
		Chairs: G. Djéga-Mariadassou and J. Faria
16h20-16h50	KN8	Innovative exhaust gas post-treatment systems for natural gas vehicles, S. Capela, P. Da Costa, GDF-Suez, Paris, France.
16h50-17h10	O15	Hydrocracking: recent trends for catalyst development, E. Guillon, IFP Energies Nouvelles, Lyon, France.
17h10-17h30	O16	CUF: from the active site to the world, P. Araújo, CUF, Portugal.
17h30-17h50	O17	Catalysis development at the service of the oil refining industry, G. Caeiro, GALP Energia, Portugal.

CLOSING REMARKS – J. Védrine, UPMC, Paris, France.

PLENARY LECTURES ABSTRACTS

PL1

"New challenges in FCC for processing heavy crudes"

Author: Avelino Corma
Instituto de Tecnología Química, UPV-CSIC, Universitat Politécnica de Valencia, Valencia, SPAIN

Processing heavier more contaminated crudes in FCC units, present new catalyst and process challenges. New laboratory reactors will needed to perform investigations in this line of work, as well as to test the new commercial catalysts.

Will present transport bed reactors with special emphasis in downflow systems and will show how they can be used to work on the new challenges presented. Finally will show new concepts to deal with feeds producing high coke yield during the FCC process.

PL2

"Impact of the Shift from Fossil to Renewable Hydrocarbon Feedstock on Design of Hydrocracking Catalysts"

Author: Johan A. Martens
Centre for Surface Chemistry and Catalysis, KU Leuven, Belgium,

Isomerization and hydrocracking using bifunctional zeolite catalysts is one of the fields where Professor Ramôa Ribeiro contributed substantially. We present this lecture on the topic of hydrocracking as a tribute to him and his scientific legacy. Isomerization and hydrocracking processes with catalysts having hydrogenation-dehydrogenation next to acid catalytic sites are established refinery processes to convert petroleum fractions into high grade lubricants and fuels. The reaction mechanisms of these processes are well understood, and catalysts have been optimized to maximize the yield of desired products. The transition from fossil to renewable hydrocarbon sources has a drastic impact on the nature of the molecules of the feedstock. For instance, Fischer-Tropsch waxes produced from synthesis gas are very long linear alkanes and hydrocarbons directly produced by algae have many methylbranchings. Pristane (2,6,10,14-tetramethylpentane) for example is one of the lighter model hydrocarbons produced by algae. Alkanes with such high branchiness are not dealt with in present day skeletal isomerization and hydrocracking processes. Molecular shape selectivity, pore mouth and key lock catalysis, acidity and metal function have been optimized mostly using model molecules relevant to petroleum based feedstock. When dealing with very long alkane chains from Fischer-Tropsch synthesis the regioselectivity of the hydrocracking reaction is critical. Splitting of very long alkanes systematically in their middle is a way to maximize diesel versus gasoline yield. Our first experiences on hydrocracking of renewable hydrocarbon compounds and especially the polymethylbranched alkanes revealed that different catalyst types will be needed. In the paper we will expand on the relative reactivity of carbon bonds in polymethylbranched molecules and the impact of pore architecture. Ideas on ways to influence the regioselectivity of skeletal isomerization and hydrocraching in long hydrocarbon chains will be presented.

PL3

“Conversion of Methanol to Hydrocarbons: How Zeolite Cavity and Pore Size Controls Product Selectivity”

Author: Pablo Beato
Haldor Topsøe A/S, Denmark.

Liquid hydrocarbon fuels play an essential part in the global energy chain, owing to their high energy density and easy transportability. Olefins play a similar role in the production of consumer goods. In a post-oil society, fuel and olefin production will rely on alternative carbon sources, such as biomass, coal, tar sands, natural gas, and CO2. The transformation of these resources to synthesis gas via reforming or gasification is based on mature technologies and opens the door to a broad spectrum of downstream products. Among many possible bulk chemicals derived from synthesis gas, methanol and dimethylether represent the most simple and straightforward transformation into a liquid and storable energy source. The use of methanol as a base chemical is also politically a favoured option since it allows being more independent from crude oil reserves.
One of the future key reactions for the conversion of methanol into more valuable products is the so called methanol to hydrocarbons (MTH) reaction, typically catalyzed by zeolites. The active site of the methanol-to-hydrocarbons reaction has been identified as a hybrid site consisting of an organic molecule in close interaction with a Brønsted acidic proton on the zeolite lattice. As the MTH reaction mainly occurs within the zeolite crystals, the product selectivity of the reaction depends strongly on the size and dimensionality of the zeolite channel system. With the present contribution, our ambition is to bring the audience up-to-date on one of today’s most fascinating and complex examples of shape-selective, acid-based catalysis.

References

[1] F. Bleken, W. Skistad, K. Barbera, M. Kustova, S. Bordiga, P. Beato, K.P. Lillerud, S. Svelle, U. Olsbye, Phys. Chem. Chem. Phys. 13 (2011) 2539.
[2] S. Teketel, U. Olsbye, K.P. Lillerud, P. Beato, S. Svelle, Microporous Mesoporous Mater. 136, (2010) 33.
[3] S. Teketel, W. Skistad, S. Benard, U. Olsbye, K.P. Lillerud, P. Beato, S. Svelle, ACS Catal. 2 (2012) 26.
[4] U. Olsbye, S. Svelle, M. Bjørgen, P. Beato, T.V.W. Janssens, F. Joensen, S. Bordiga, K.P. Lillerud, Angew. Chem. DOI: 10.1002/anie.201103657

PL4

“From laboratory research to foundations of Process Industrialization”

Author : Jean-François JOLY
IFP Energies nouvelles, Lyon,
France

Process development aims to transform an idea, resulting from research mostly conducted in a laboratory, into an industrial innovation which consists of a new reliable process that is cost-effective with the smallest ecological footprint possible. This article illustrates the major stages of process development [1,2], until obtaining the foundations of industrialization, and to highlight the benefits of an “integrated” approach to the development process as well as the predominant place of modeling, at different stages of the development process. This methodological approach enables faster developments of processes, that are safer in terms of scale-up, the costs of the development phase being reduced.

From the pre-development phase of a process, key points as well as any appropriate science and technological barriers that are to be removed in the further development of the process are identified. Pre-estimation of technical and economic performances of the process is also established from strong hypotheses, especially by assuming the removal of technological barriers identified in the initial design of the process scheme. From this first phase, the elements of decision which enable us to validate or not the viability of the concept and, if necessary, switch to the development phase of the existing process, were obtained through a rigorous scientific approach.

During the development phase, the acquisition of the set of data essential for the development of the process is the longest phase. The basic data to be acquired are defined at the end of the pre-development phase: reaction kinetics, product quality, stability over time of performances, thermodynamic data, mass and heat transfer, and so on.

[1] Selection of process and mode of operation, Jean-François Joly, Eric Sanchez and Karine Surla
[2] Deactivation and Regeneration of Zeolite Catalysts, pp. 177 – 200, edited by Michel Guisnet & Fernando Ramôa Ribeiro, Imperial College Press, 2011
[2] Fondation of Process Industrialization, Jean-François Joly. Process Engineering and Industrial Management,pp. 147-188, Edited by Jean-Pierre Dalpont, Wiley 2012

LIST OF POSTERS

POSTER SESSION

P1 Hydroformylation-sequential reactions as synthetic tools towards high value products, A.C.B. Neves, A.R. Almeida, L.D. Dias, A.D. Batista, R.Dias, R.M.B. Carrilho, A.R. Abreu, C.J.P. Monteiro, M.J.S.M. Moreno, M.J.F. Calvete and M.M. Pereira.

P2 Coupling of nanoporous chromium, aluminium-containing silicates with an ionic liquid for the transformation of glucose into 5-(hydroxymethyl)-2-furaldehyde, M.M. Antunes, S. Lima, M. Pillinger and A. Valente.

P3 New heterogeneous catalysts for the synthesis of chiral amino acids: functionalization of organic resins with chiral salen complexes, M.A. Esteves, C. Santos, A.M. Guerreiro, C. Baleizão and B. Gigante.

P4 Cyclization of alkynols promoted by camphorimine complexes, M.F.N.N. Carvalho, A.S. Ferreira.

P5 Hydroformylation of natural fatty acid methyl esters catalyzed by Rhodium-monophosphite complexes, R.M. B. Carrilho, G.N. Costa, A.R. Abreu and M.M. Pereira.

P6 Valorization of vegetable oil deodorizer distillate by a combined process of an enzymatic-catalyzed esterification and membrane processing, A.R.S. Teixeira, J.L.C. Santos and J.G. Crespo.

P7 Catalytic dehydrogenation of 2-arylpyrrolines: a selective reaction for the synthesis of 2-arylpyrroles, C.A. Figueira, P.T. Gomes.

P8 Isomerisation of α-pinene oxide in the presence of indenyl derivatives of molybdenum and tungsten, S.M. Bruno, C.A. Gamelas, A.C. Gomes, A.A. Valente, M. Pillinger, C.C. Romão, I.S. Gonçalves.

P9 Amino-grafted SBA-15 efficiently catalyzing the synthesis of coumarins: experimental and theoretical study, N. Aider, E. Pérez-Mayoral, E. Soriano, R. M. Martín-Aranda, A. J. López-Peinado, J. Cejka, D. Halliche, S. Dellah.

P10 Nickel N-heterocyclic carbene complexes: catalysts for hydrosilylation of carbonyl groups, L. Postigo, B. Royo.

P11 Biodiesel production over lime catalyst. The role of Ca species formed during the oil methanolysis, J. Puna, J. Gomes, J. Bordado, M.J. Neiva Correia, A.P Soares Dias.

P12 Periodic mesoporous organosilicas functionalized with sulfonic acid groups on the catalytic dehydration of fructose to 5-hydroxymethylfurfural, C. Bispo, P. Ferreira, K. Vigier, F. Jérôme, N. Bion.

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IST subway stations Saldanha and Alameda
Coroa 1
Zone 1
Coroa L
Zone L
Odivelas
Senhor Roubado
Ameixoeira
Lumiar
Quinta das Conchas
Campo Grande
Telheiras
Cidade Universitária
Amadora Este
Alfornelos
Pontinha
Carnide
Colégio Militar /Luz
Alto dos Moinhos
Laranjeiras
Benfica
Sintra
Jardim Zoológico
Sete Rios
Entre Campos
Campo Pequeno
Praça de Espanha
Campolide
S. Sebastião
Parque
Marquês de Pombal
Rato
Avenida
Restauradores
Rossio
Baixa-Chiado
Alcântara-Terra
Alcântara-Mar
Santos
Cais do Sodré
Cascais
Lisboa
Belém
Rio Tejo
Porto Brandão/Trafaria
Faro/Setúbal
Montijo
Seixal
Cacilhas
Barreiro
Terreiro do Paço
Santa Apolónia
Aeroporto
Encarnação
Moscavide
Oriente
Alvalade
Roma
Areeiro
Saldanha
Picoas
Cabo Ruivo
Olivais
Roma/Areeiro
Chelas
Bela Vista
Olaias
Alameda
Arroios
Anjos
Intendente
Martim Moniz
Rossio
Braço de Prata
Marvila
Azambuja/Porto
Aeroporto
Airport
Autocarro suburbano
Suburban bus
Barco
Boat
Comboio
Railways
Gabinete do Cliente
Customer Service Office
Mobilidade reduzida
Step free
Perdidos e achados
Lost property
Polícia
Police
Interface comboio/metro
Percurso pedonal
Comboio
Railways
Metro
underground
linha Azul
Blue line
linha Amarela
Yellow line
linha Verde
Green line
linha Vermelha
Red line
julho 2012

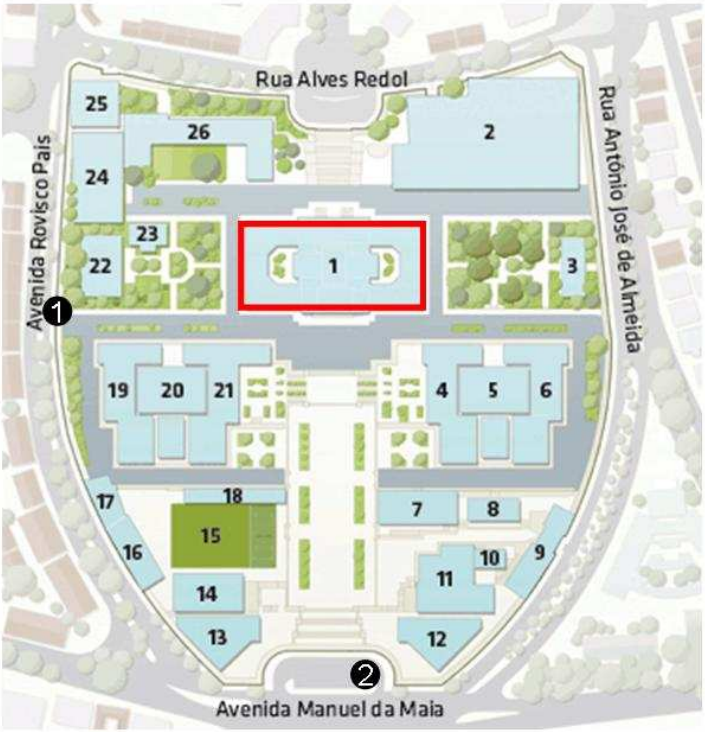
❶ Hotel AS Lisboa

❷ Hotel Holiday Inn

❸ Hotel Turim

❹ Hotel Fonte Luminosa

Metro stations



1 Pavilhão Central
2 Pavilhão de Civil
3 Pavilhão do Jardim Norte
4 Pavilhão de Mecânica I
5 Torre Norte
6 Pavilhão de Electricidade
7 Pavilhão de Informática II
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9 Pavilhão de Informática I
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14 Pavilhão da Associação de Estudantes
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25 Pavilhão de Física
26 Complexo Interdisciplinar

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