



JUNE 2ND - 4TH 2015 MAT4BAT SUMMER SCHOOL

M₄B Summer School

MAT₄Bat Summer School will give presentations, discussions and round tables about the different research orientations chosen to develop next generations of Li-ion batteries for electric vehicles.

Speakers will include experts in the field of materials for Li-Ion batteries.

**WELCOME TO
EIGSI**

**WIFI ACCESS:
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PAGE**

**SPEAKERS FROM
ACADEMIA AND
INDUSTRY**

**SUMMER-SCHOOL
ON MATERIALS FOR
BATTERIES**

**EUROPEAN
RESEARCH FUNDED**

EIGSI

26 rue de Vaux de
Foletier
17000 La Rochelle

June 2ND - 4TH



MAT₄BAT Summer School

Hosted by

EIGSI Engineering School

26 rue de Vaux de Foletier, La Rochelle, France



WIFI ACCESS

We are pleased to offer a Wifi connection for today's meeting. Let us know if you have any difficulties, we will be pleased to assist you (please pay attention to letter case)

LOGIN	guest
PASSWORD	MAT₄bat15



Acknowledgments

MAT₄BAT project is funded by the European Union's Seventh Framework Program (FP7/2007-2013) under grant agreement n°608931.

PROGRAM

2nd June

14:00/14:30 - Introduction

- Introduction by EIGSI representatives
- Presentation of the Summer School & practical information

14:30/15:00 - Industrial partner presentation: AVERE France

Abstract: Avere-France is the information, exchanges and national expertise that brings together all players in the ecosystem of electric mobility. The main tasks of the association beyond the promotion and information on electric mobility are to unite the sector among other things through the structuring of a network of regional associations and to be the representative of this sector with the public authorities.



Joseph Beretta
Head of AVERE
France
association

Biography: Joseph Beretta is INSA Lyon engineer in electrical engineering with a master of energy. He has a 14 years' experience in the industry of power electronics for control of electric motor and 20 years in the automotive industry at PSA Peugeot Citroën. He led the research and innovation in both electronic and electric vehicles on board. He held the post of delegate energies technologies and innovation have the direction of public affairs or it was the interlocutor towards French and European public authorities in areas as diverse as the diesel, gasoline, electric engines / hybrid and the financing of major innovation projects. He was also seconded to the Ministry of research to represent the France in the definition of framework (FPRD) multi-year research European programs in the field of transportation land. Engaged for a long time in electric mobility in active way, Joseph Beretta is now President of Avere-France and Vice President of AVERE Europe.

15:00/15:30 Overall presentation of the Mat4Bat European project



Sébastien MARTINET
CEA/Liten
Electrochemical Storage
Specialist

Biography: Sébastien Martinet has 20 year experience in the battery field. He started working with SAFT with a PhD on NiMH batteries and some experience in the safety of Li-Ion batteries. Then he integrated CEA to set-up Li-Ion processing line and was in charge of the laboratory of lithium batteries. He is now in charge of scientific topics related to batteries at CEA-LITEN.

15:30/16:00 - City Mobil 2 : Experimentation of a driverless bus prototype in La Rochelle

Abstract: CityMobil2 is setting up a pilot platform for automated road transport systems, which will be implemented in several urban environments across Europe. A dozen local authorities or equivalent sites are in the bidding to be one of the five sites to host a 6-month demonstration.



Tatianna Graindorge
Researcher at at EIGSI
Engineer School

Biography: Tatianna Graindorge holds a PhD in Physical Sciences and Engineering from University of Bordeaux. From 2009, she has been working in the field of urban mobility of goods and passenger. Topics range from mobility management, freight transport to project evaluation. She is in charge of the management and of the assessment of the impacts of urban transport demonstrations project carried out within the framework of European and national projects.

16:00: 17:00 - Coffee break

17:00/18:00 - Posters session

- *European Li-Ion Battery Advanced Manufacturing (ELIBAMA)*,
PEYRARD Jérôme, Renault SAS
- *Progress in negative electrode development for lithium ion batteries*,
GONZALO Elena Candida, CIC Energigune
- *FAULTS: an accessible program for refining powder diffraction patterns of layered structures*,
REYNAUD Marine, CIC Energigune
- *Li_{1.2}Ni_{0.2}Mn_{0.6}O₂ cathode materials for rechargeable lithium ion batteries*,
ITURRONDOBEITIA Amaia, CIC Energigune
- *High-capacity Lithium-Air batteries with Long Cycle Life*,
AMICI Julia, Politecnico di Torino
- *Lithium-ion cell dynamic models : electrochemical and electric-thermal approach*,
AYERBE Elixabete, IK4-CIDETEC
- *Johnson Matthey Battery Technologies : Advanced Materials Research*,
MARANSKI Krzysztof, Johnson Matthey
- *Advanced manufacturing processes for Low Cost Greener Li-Ion batteries (GREENLION)*,
CENDOYA Iosu, IK4-CIDETEC
- *The French SIMCAL research network for studying and modeling the calendar aging of Li-Ion batteries*,
DELAILLE Arnaud, CEA Liten on behalf of the SIMCAL consortium
- *Influence of Discharge Currents and Cell Design on Thermal Behavior of Lithium-ion Batteries – Pouch vs. Cylindrical Cells*
WALDMANN Thomas, ZSW – Zentrum für Sonnenenergie- und Wasserstoff-Forschung
- *Characterization of Surface Films on Anodes by Glow Discharge Optical Emission Spectroscopy (GD-OES) – SEI Growth vs. Lithium Deposition*
Ghanbari Niloofar, ZSW – Zentrum für Sonnenenergie- und Wasserstoff-Forschung
- *Technical-economical interest of Lithium-ion*,
PILIPILI MATADI, CEA Liten

3rd June

09:00/09:30 - Successful water processing of cathode materials for lithium-ion batteries

Abstract: The water processing of carbon/graphite anodes is the state of the art of lithium ion battery technology. However, direct exposure of lithium containing cathode materials in water is a recognized problem in the industry due to many serious issues. CIDETEC has developed LiFePO_4 and $\text{LiNi}_x\text{Co}_y\text{Mn}_z\text{O}_2$ cathodes prepared using waterborne binders. CIDETEC's results show that proper selection of active and inactive materials and processing conditions is key point of successful manufacturing of cathodes. Finally, promising cycle life assessment of lithium ion pouch cells with aqueous processed electrodes has been achieved.



Andriy Kvasha
CIDETEC
Project manager

Biography: Dr. Andriy Kvasha received his Ph.D. degree in technical electrochemistry from Ukrainian State Chemical Technology University in 2004. His Ph.D. thesis was dedicated to synthesis, investigation and application of solid glassy electrolytes in lithium power sources. He has more than 15 years of academic and industrial experience in research and development of lithium and lithium-ion batteries. Since 2006 he has worked as senior engineer of R&D department of Samsung SDI (South Korea). In 2012, Dr. Kvasha joined IK4-CIDETEC in San Sebastian (Spain) as researcher and project manager in the field of lithium ion batteries R&D. He is author of several scientific papers and 2 patents. Dr. Kvasha has participated in several national and international scientific and R&D projects.

09:30/10:00 - Active material cathode Li-Rich

Abstract : Materials of generic formula $\text{Li}_{1+x}\text{M}_{1-x}\text{O}_2$ ($\text{M}=\text{Ni}, \text{Mn} \dots$) also called Li-rich material in comparison to classic cathode materials LiMO_2 are most promising cathode materials thanks to their high capacity that can reach up to 250mAh/g. To reach such a capacity, several original mechanisms are put into play with a participation of oxygen to the electrochemistry and cationic migration. Unfortunately such complex mechanisms imply several drawbacks like a high first irreversible capacity, a degassing during the first cycles and a fade of the working voltage, which hinders its application in the market. During these last years, we carried several studies on this mechanism thanks to synchrotron studies at the ESRF, electronic microscopy at the Nano-Characterization Platform, and electrochemistry. We will present this characterization and their impact on our material development.

Jean-François Colin,
CEA/Liten

Biography: After a PhD, obtained in 2007, on the synthesis of titanoniobates as anode materials for Li-ion batteries via solid state synthesis and soft chemistry in Caen, I spent 2 years at the Paul Scherrer Institute to develop in situ characterization techniques of cathode materials in the Electrochemistry Laboratory. I then joined CEA at the beginning of 2010 and am now in charge of the synthesis and development of new electrode materials.

10:00/10:30 - Active material anode (LTO - industrial)

Abstract: Presentation and results of the ELIBAMA project European Li-Ion Battery Advanced Manufacturing.

**David Eskenazi,
PRAYON**

Biography: Master's degree in chemical engineering (2010, University of Liège), PhD in chemical engineering about the nitridation of solid electrolytes for micro batteries (expected in 2015, University of Liège). Joined Prayon in 2013 as a R&D engineer for improving industrial production processes of cathode materials (LFP). In charge of the final milling step which involves impact and jet milling technologies.

10:30/11:00 - Coffee break

11:00/11:30 - Carbon-based negative electrode active materials for lithium-ion batteries – past, present and trends towards the future

Abstract: Starting with a comparison of electrochemical characteristics exhibited by different types of carbon that have historically been used as negative electrode materials in lithium-ion batteries (coke, hard & soft carbon, MCMB, synthetic & natural graphite), current uses of anode active materials in different end applications are elaborated: hybrid electric vehicles (HEV), plug-in hybrid electric vehicles (PHEV), battery electric vehicles (BEV), grid storage and consumer electronics. The presentation will end with an analysis of literature trends towards carbon-based composite materials with stable reversible capacities above the theoretical limit of graphite (372 Ah/kg).



Pirmin ULMANN
IMERYS Graphite
& Carbon
Development
Scientist

Biography: Dr. Pirmin Ullmann graduated in 2004 with a diploma in chemistry from ETH Zurich (Switzerland). In 2009, he received a PhD from Northwestern University in Evanston, IL (USA). From 2009 to 2010, he participated as a JSPS Foreign Fellow in a project related to fullerene-based organic solar cells at the University of Tokyo (Japan). Since 2010, he works for IMERYS Graphite & Carbon in Bodio (Switzerland) as an R&D project coordinator in the field of carbon materials for lithium-ion batteries.

11:30/12:00 - Round table (active materials)



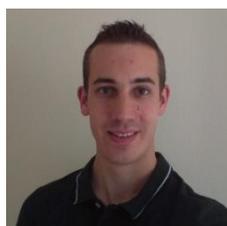
Animator :
Elena C. Gonzalo
Researcher at
CICenergigune

Biography: Elena C. Gonzalo Martín studied Chemistry at Complutense University (Madrid, Spain). She received her M. Sc. in "Synthesis assisted by MW energy of new cathode materials" in 2006 at Complutense University directed by Dr. Carmen Parada. She obtained her PhD in 2011 at Complutense University titled: "Transition Metal Fluorides and Chlorides as electrodes for lithium batteries with high specific energy: synthesis, structural characterization and electrochemical features" working with Prof. Flaviano García-Alvarado and Dr. Alois Kuhn. She has got the PhD Thesis Award of 2010-2011 of the Chemistry Faculty of Complutense University. Nowadays, she is working at CICenergigune as a PostDoc focusing on new Li- and Na- based electrode materials for rechargeable batteries.

12:00/13h30 – Lunch

13:30/14:00 - Electrode formulation and processing

Abstract: Electrode slurries formulation and electrode coating are key steps for lithium-ion batteries manufacturing. Nowadays electrode manufacturing process enables the production of billions of batteries per year at industrial scale but there is still room for process optimization as new electrode materials will be scaled-up, costs need to be reduced and cell performances targets are always higher. We propose to survey formulation methodology and mixing / coating process by highlighting examples from Mat4Bat project achievements as well as other European projects. Attention will be paid towards water-based electrode processing which is a promising way to reduce environmental impact and overall cell costs.



Dane SOTTA
CEA Liten
Research Engineer

Biography: Dane Sotta is electrochemistry engineer and he received a PhD from Université de Picardie Jules Verne (Amiens, France) in 2011. The topic of his PhD thesis was to develop new gelled electrolytes based on ionic liquids for lithium-ion batteries. Then he joined CEA-Liten (Grenoble, France) and he works now as research engineer within a laboratory dedicated to development and manufacturing of components for energy storage and conversion devices such as batteries and fuel cells. He is in charge of electrodes formulations developments for lithium-ion batteries in several FP7 and H2020 European projects.

14:00/14:30 - Life cycle assessment and environmental impact of materials for batteries

Abstract: This presentation will give a short introduction to life cycle assessment (LCA) and will use the case of batteries as an example. Life cycle assessment is a method used to investigate the environmental impact of products throughout their life cycle, starting with the extraction of raw materials, through the production process, the transport steps, the use phase and finally the end of life. When performing an LCA, all inputs (resources and energy consumed) and outputs (emissions and waste) are quantified and their potential effects on the environment, human health and resource depletion are determined. One of the strengths of LCA is that it takes into account the total life cycle and thus avoids burden shifting between life cycle phases or type of environmental effect. The results of an LCA can be used, for example, to gain insight into the environmental hotspots in the supply chain, to make a comparison of the environmental impacts of products with a similar function or to assess how a specific application of a product would affect the environmental impacts.



Katrien BOONEN
VITO
Researcher

Biography: Katrien Boonen graduated as a bioengineer at KULeuven in 2007 and had her first work experience in the food industry. She started working as a researcher at VITO in 2010, as part of the team that does sustainability evaluations. She works mostly on studies related to life cycle assessment (LCA). Some examples are determining the environmental impact of products, helping sector organizations with the preparation of product category rules (PCR) and calculating the eco-efficiency of projects. These studies are carried out on behalf of governments and companies at home and abroad, such as producers of food, bio-based products and metal products.

14:30/15:00 - Thermal Characterisation of the Intrinsic Safety Behaviour of Lithium-ion Materials and Batteries

Abstract: A high safety is one of the most important prerequisites for the successful market expansion of Li-ion cells. Even a moderate increase of the cell temperature can cause degradation or decomposition reactions depending on the used cell materials. These reactions can lead to a thermal runaway up to the destruction of the cell and the release of harmful emissions. Thus it is important to understand the thermal behaviour of the different cell components, the possible reactions between the components and finally to identify the initial reactions of the thermal runaway. For the characterisation of the intrinsic thermal behaviour of cell materials up to the cell level, different analytical methods are available. This contribution presents an overview of thermal methods. The focus here will be not only on the single methods, but also on a useful combination of methods to get an overall picture.



Thomas WALDMANN
ZSW
Project manager

Biography: Dr. Thomas Waldmann studied chemistry at Ulm University. After receiving his PhD in physical chemistry in 2011, he joined Dr. Wohlfahrt-Mehrens' group at ZSW as a project manager and started working on aging phenomena and Post-Mortem analysis of lithium-ion batteries. Dr. Waldmann published several papers in peer-reviewed scientific journals and 50 conference contributions.

15:00/15:30 - Coffee break

15:30/16:00 – Binders

**Roberta Colombo, Solvay Specialty Polymers
Lithium-Ion Batteries Researcher**

16:00/16:30 – Electrolytes for lithium ion batteries for electric vehicles

Abstract: The requirements for lithium ion batteries for electric vehicles are challenging. In comparison to consumer cells, many issues need to be reviewed to meet the demanding targets of a battery that has to compete with the well-established combustion engine technology in automobiles. The talk will give an overview of the factors that need to be considered when it comes to the electrolyte in a lithium ion cell. Examples and approaches to solutions will be given with respect to cell performance, safety, lifetime, costs and availability and processability.



Jörg Kaiser
KIT
Project manager

Biography: Dr. Jörg Kaiser (KIT) studied chemistry at the universities in Düsseldorf (Germany) and Davis (USA). He obtained his PhD from the University of Ulm (Germany) with a thesis on electrocatalysts for fuel cells anodes, followed by a post-doc at the ZSW Ulm working on fuel cell cathodes. In 2006 he joined Degussa as a team leader for R&D and as an assistant to manager of an electrolysis factory. Later he became head of R&D at Li-Tec Battery, a joint venture of Evonik (formerly Degussa) and Daimler, developing lithium ion cells for - among others - the Smart electric vehicle. Since 2012 he is head of cell development at Competence-E at the Karlsruhe Institute of Technology (KIT).

16:30/17:00 – - Round table (Cell design and manufacturing)

- Animator: Dr Jörg Kaiser, KIT, Project manager

4th June

9:00/9:30 - Calendar ageing of Li-ion batteries: results from ageing tests and understanding from autopsies

Abstract: This presentation dedicated to the calendar ageing of Li-ion batteries will contain two main parts: the first part will be dedicated to the presentation and discussion of experimental results, while the second part will address the understanding of the mechanisms responsible of this ageing mode. This presentation will be mainly based on data from 2 collaborative projects: SIMCAL, a French Project funded by ANR (2009-2012), and the MAT₄BAT project currently in progress (2013-2017).



Arnaud Delaille
CEA Liten
Head of Laboratory

Biography: Dr. Arnaud Delaille, graduated of a PhD of the University of Paris VI in 2006. From 2006 to 2014: Project Manager at the CEA (French Alternative Energies and Atomic Energy Commission) involved in Battery Management System activities. Since 2014, he is Head of the Laboratory for ElectroChemical Storage (CEA-LSEC), involved in the characterization, the modeling, and the management of the different battery technologies. He is particularly involved in the WP1 of the European Project Mat4Bat, on the ageing understanding and modeling of innovative Li-ion batteries.

9:30/10:00 – Cycling Ageing of Lithium-Ion batteries

Abstract: This presentation dedicated to the cycling ageing will be mainly based on ageing data from state of art Li-Ion C/NMC cells tested within the work package of the MAT₄BAT project currently in progress (2013-2017).



Sébastien GROLLEAU
Researcher at EIGSI Engineer School

Biography: Dr. Sébastien Grolleau holds a master degree in energy engineering from the Engineer School ISAE, Toulouse. In 2013, he received his PhD from University Caen Basse-Normandie; Li-ion his subject thesis was the ageing study and modelling of high power lithium-ion technologies with a special focus on aging due to storage. Since 2014, he joined the Engineer School EIGSI as a research engineer and works on national and international research projects focused on aging of lithium-ion batteries. He contributes actively to calendar and cycling ageing studies on full lithium-ion cells in the WP1 of the European Project Mat4Bat.

10:00/10:30 - Coffee break

10:30/11:00 - *Diagnosis & post-mortem analysis*

Abstract: Lithium-ion batteries with state-of-the-art technology suffer from aging mechanisms, limiting their life time in applications. In order to improve battery life on a knowledge-based approach, aged batteries have to be disassembled and their components – anode, cathode, separator, and electrolyte – have to be analyzed with physico-chemical methods. This process is known as Post-Mortem analysis and involves a variety of steps such as controlled ambient conditions to ensure reproducible and interpretable results on aging mechanisms. Characterization of components can be done with methods such as ICP-OES, EDX, GD-OES, XRD, SEM, and optical microscopy. Typical aging mechanisms are metal dissolution from the cathode, SEI growth or deposition of metallic lithium on the anodes and will be shown on selected examples from Post-Mortem analysis.



Thomas WALDMANN
ZSW
Research project manager

Biography: Dr. Thomas Waldmann studied chemistry at Ulm University. After receiving his PhD in physical chemistry in 2011, he joined Dr. Wohlfahrt-Mehrens' group at ZSW as a project manager and started working on aging phenomena and Post-Mortem analysis of lithium-ion batteries. Dr. Waldmann published several papers in peer-reviewed scientific journals and 50 conference contributions.

11:00/11:30 – *Ageing modelling*



Philippe GYAN
RENAULT SAS
Research Engineer

Biography : Dr. Philippe Gyan graduated from the Ecole Centrale de Lyon with a Master of Science in 1998, and with a Ph.D in 2003, in Mechanical Engineering, Energy and Thermal Management. He worked then at Renault Mechanical Department, on the deployment of calculation tools for vehicle performances and fuel economy. Since 2008, he has been working in the Research Department at Renault, on power train sizing for Electric Vehicles, on battery electrical, thermal, and ageing modeling, and on the consideration of climate and environment conditions in energy consumption and vehicle range calculation. He was involved in the French national collaborative projects SIMSTOCK and SIMCAL, on battery ageing modeling, and is author of several publications.

11:30/12:00 *Lithium-Sulfur Technology: recent developments and perspectives*



Sébastien MARTINET
CEA/Liten
Electrochemical Storage
Specialist

Biography: Sébastien Martinet has 20 year experience in the battery field. He started working with SAFT with a PhD on NiMH batteries and some experience in the safety of Li-Ion batteries. Then he integrated CEA to set-up Li-Ion processing line and was in charge of the laboratory of lithium batteries. He is now in charge of scientific topics related to batteries at CEA-LITEN.

12:00/13:30 – Lunch

13:30/14:00 - Next generation batteries

Abstract: The presentation starts with battery market analysis. Then the technical evolutions are presented from chemistry to production. Both aspects will highlight The Next Generation Batteries.



Philippe DESPREZ
SAFT
System Group Manager

Biography: Philippe Desprez is Engineer and PhD in Process Engineering from the French National Engineering School of Chemical Industries (ENSIC) in Nancy, France. In 1997, he continues developing his expertise in Micro-Electronics by joining the company, SemiTool (US-MT). He moved to Alcatel, then SAFT group dealing with batteries and supercapacitors in 1999. As group manager at the SAFT R&D division in Bordeaux, France since 2006, he is at the head of transversal system activities ranging from electrochemical cells to battery systems for mobile and new energy applications. He is also an expert for the French National Research Agency (ANR) and for the European Commission.

14:00/14:30 - Battery industry prospective in Europe and new technologies



Claude CHANSON
RECHARGE association
General Manager

Biography: Claude Chanson is Engineer in chemistry and physics from Bordeaux ENSCPB (1982) and has obtained a PHD in Electrochemistry in Bordeaux 1 University (1986). He previously served in Saft as an engineer in R & D and project manager in the telecommunications and automotive, before taking the office of Division Technical Manager and finally for Saft Group, the mission of Director of the Li-ion technology. He has moved to RECHARGE, representing the rechargeable battery industry interests with the Europeans Bodies, since 3 years.

14:30/15:00 - Round table (Next Gen batteries)

- Leader : *Sébastien MARTINET (CEA/Liten), Researcher at CEA/Liten*

15:00/15:10- Conclusion of the Summer School

Tuesday, 2nd June, 19:00 COCKTAIL RECEPTION + DINNER

Registered guests have to meet @ Restaurant Hotel Mercure @ 19:00, 2nd June. The restaurant is located in the city centre*.

Wednesday, 3rd June, 12:00 JOIN US FOR LUNCH

We have a reservation @ University Restaurant République @12:00. The restaurant is in front of EIGSI (walk 5 min)*.

* see the map at the end of this document on the last page

Directions to EIGSI



- By train
 - Paris (TGV high speed train): 3 hours 15 minutes
 - Nantes: 90 minutes
 - Bordeaux: 90 minutes
 - Poitiers: 75 minutes
- By bus
 - Lines 17 and ILLICO, "EIGSI" stop
- By Taxi
 - Taxi "abeilles" : + 33 5 46 41 22 22

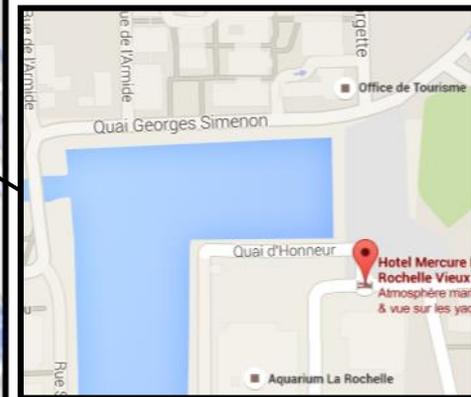
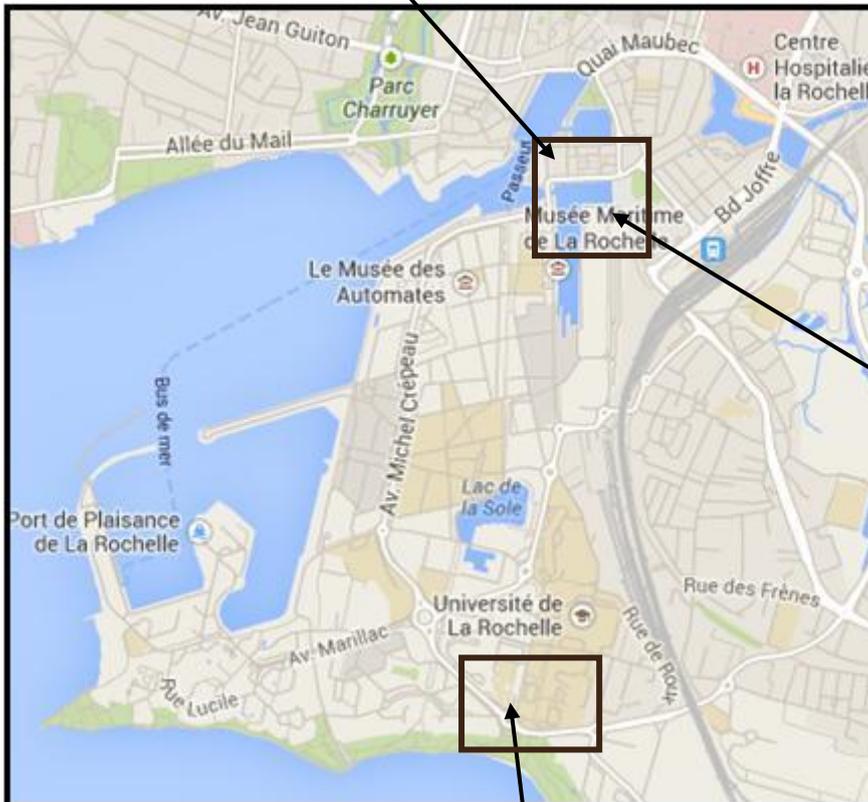
Schedules available on the website www.rtc.fr

Places to know...



Office de tourisme

2 Quai Georges Simenon,
17000 La Rochelle



Hôtel Restaurant

« Mercure »

Quai Louis Prunier
17000 La Rochelle

EIGSI

26 rue de Vaux de Foletier
17000 La Rochelle



Restaurant

« République »

Université de La Rochelle
17000 La Rochelle