

COLLOQUE



organisé par le Réseau sur le Stockage Electrochimie de l'énergie (RS2E),
Pr Jean-Marie Tarascon et Pr Patrice Simon

soutenu par le Ministère de l'Enseignement Supérieur et de la Recherche et le
Ministère de l'Economie, des Finances et de l'Industrie



La sécurité des batteries à ions lithium: Possibilité de risque zéro ?

7 Novembre 2011



Le stockage électrochimie de l'énergie, tant pour l'exploitation des énergies renouvelables que pour le développement du véhicule électrique, est devenu un des plus grands challenges du 21^{ème} siècle. Les batteries, et notamment celles utilisant la technologie à ions Li, sont actuellement les plus convoitées pour leurs applications grand volume, sous réserve de la diminution de leur coût et de l'amélioration de leur sécurité. Ce dernier point a fait le sujet de nombreux débats médiatiques ces derniers mois, mais qu'en est-il réellement de cet aspect sécuritaire ? C'est pour répondre à cette interrogation que le RS2E organise une journée conférence-débat sur la sécurité des accumulateurs à ions Li. Ce colloque se voudra avant tout éducatif et informatif. Il rassemblera des présentations d'experts scientifiques internationaux couvrant (i) l'aspect matériaux, systèmes et intégration véhicule électrique mais aussi (ii) les risques pouvant exister pour les utilisateurs selon des scénarii différents. Ce débat se clôturera par une table ronde.

Programme

Présidé par **M. Fontecave**

(Professeur au Collège de France et Membre de l'Académie des Sciences)

MATIN

- 8:45 - 9:00** **M. Fontecave**
Adresse de bienvenue
- 9:00 - 9 :30** **Y. Chabre** (Consultant)
Introduction aux batteries pour véhicules électriques
- 9:30 - 10:00** **K. Amine** (Argonne National Laboratory, USA)
Impact of battery materials on the safety and ways of mitigating the thermal runaway of lithium batteries for automotive applications
- 10:00 - 10:30** **J. Reimers** (Magna E-Car Systems)
The top 5 myths about Li-ion cell safety
- 10:30 - 11:00** Pause
- 11:00 - 11:30** **Guy Marlair** (Ineris)
Safety issues pertaining to rechargeable Li-based batteries: "Current knowledge from literature review and abuse testing and perceived remaining research topics"
- 11:30 - 12:00** **M. Armand** (Directeur de Recherches honoraire CNRS-LRCS)
Prospective sur l'aspect sécurité via de nouveaux électrolytes
- 12:00 - 12:30** **Yo Kobayashi** (CREIPI, Japan)
Status on safety of large lithium-ion batteries in Japan
- 12:30 - 14:00** Déjeuner

APRES-MIDI

- 14:00 - 14:30** **Guillaume DEDEREN** (Sécurité Civile, bureau d'expertise de résilience aux risques)
Risques liés aux batteries des véhicules électriques : la démarche de la sécurité civile
- 14:30 - 15:00** **Jean-Yves LE COZ** (Expert Leader Sécurité Routière, Renault)
Safety of the battery electric vehicle: a global approach
- 15:00 - 15:30** **Daniel Doughty** (Battery Safety Consulting Inc., USA)
Battery Abuse and Safety Test Procedures for Electric and Hybrid Electric Vehicles - Review and Analysis
- 15:30 - 16:00** Pause
- 16:00 - 16:30** **Prof. Xinping Qiu** (Prof., Tsinghua Univ.)
Safe status of lithium-ion batteries in Chinese EVs Demonstration and strategies for safety improvement
- 16:30 - 18:00** **Table Ronde** animée par J.M. Tarascon et P. Simon avec:
A. de Guibert (SAFT), S. Lascaud (EDF), D. Gounot (E4V), D. Marginèdes (Bolloré), B. Sahut (PSA) et R. Bastien (Renault)
- 18:00** Conclusions – **J.M. Tarascon**

**Certaines conférences seront en anglais.
Une traduction simultanée sera assurée.**

Toute l'actualité: www.college-de-france.fr

amphithéâtre Marguerite de Navarre
11, place Marcelin Berthelot – 75005 Paris
accès libre dans la limite des places disponibles

Conferences Abstracts & Biographies

Introduction to batteries for electric vehicles, by

Yves Chabre, Consultant

Abstract: The characteristics of the various types of batteries used in the « electric and hybrid vehicles » will be discussed: Lead-acid, nickel/metal hydride, lithium-ion, lithium metal polymer and sodium/Ni chloride.

Biography: Dr. Yves Chabre is a former CNRS researcher in physics of solids who worked for twenty years on active electrode materials for batteries. He is presently acting as consultant dealing with the problems related to batteries for electric vehicles applications with designers, car manufacturers, users, administrators.



Impact of battery materials on the safety and ways of mitigating the thermal runaway of lithium batteries for Automotive applications, by

K. Amine, Professor, Argonne National Laboratory; USA

Abstract: The impact of the anode, SEI breakdown, cathode and separator on lithium ion battery safety will be discussed. Several technologies that mitigate the thermal run away in batteries will be I will be talking about the impact of anode, SEI breakdown, cathode and separator on lithium ion battery safety. Several technologies that mitigate the thermal run away in batteries will be disclosed and videos of safety tests done in collaboration with the industry using these technologies shown.

Biography: Dr. Khalil Amine is a Senior Fellow Scientist and the Manager of the Advanced Lithium Battery Program at Argonne National Laboratory, where he is responsible for directing the research and development of advanced materials and battery systems for HEVs, PHEVs, EVs, satellite, military and medical applications. Dr. Khalil currently serves as an Advisor to the U.S. National Research Consul on battery related technologies. He received numerous awards, the last in date being international battery association award. Dr. Amine holds or has filed over 120 patents and patent applications and has over 254 publications.



The top 5 myths about Li-ion cell safety, by

James Reimers, Magna E-Car Systems

Abstract: New comers to the Li-ion business often get conflicting stories and opinions regarding the safety if Li-ion cells. Critical regulatory tests and how not to interpret the results will be discussed. The top 5 myths that I have encountered over the past 20 years will be described in detail.

Biography: Jan Reimers has more than 20 years of experience in Li-ion cell business. Jan received his Ph.D. in Chemical Physics from McMaster University, after which he worked with Jeff Dahn for two years as an NSERC Post Doctoral Fellow. After joining Moli-Energy he was involved in commercialising the industry's first Li-ion cells with a Mn (LMO) based cathode. During this work at Moli Jan dealt with all aspects of materials and safety associated with Li-ion cells. Jan is now with Magna E-car Systems.



Safety issues pertaining to rechargeable Li-based batteries: "Current knowledge from literature review and abuse testing and perceived remaining research topics",

by Guy Marlair, INERIS

Abstract: The lecture will focus on safety challenges caused by the development of high power/high energy batteries making use of lithium in their electrochemistry. The attempt will be made to sort out actual knowledge from missing information deserving research at the light of incident review, published results, own research activities and announced R&D roadmaps in the field (USA, Japan). In particular, issues in relating with cell gas venting during thermal runaway or emissions under internal external fire conditions will be dealt with.

Biography: Guy MARLAIR has been working for INERIS (formerly CERCHAR) for nearly 30 years. He started his career as a testing engineer in the field of fluidized bed combustion. His commitment into the analysis of battery safety (and also supercaps) takes advantage of significant experience of industrial fire issues including materials and chemicals of all sorts, including fire-induced toxicity threats. He has pioneered the use of modern fire calorimetry (Tewarson calorimeter) at the EU level for characterizing the thermal and chemical threats of chemicals in fire conditions in a scientific-sound manner. Also active in national and international fire safety standardization committees.



Prospective sur l'aspect sécurité via de nouveaux électrolytes, by

Michel Armand, CNRS

Abstract: The problem of batteries safety more specifically linked to the nature/composition of electrolytes in comparison to a choice of given electrodes will be presented. On this basis, various routes for the creation of new salts and solvents more promising as regards security will be discussed and a few concrete examples will be given.

Biography: Dr. M. Armand is a CNRS honorary Research Director. He has been involved in developing the lithium battery field since the earlier years of high energy-density battery research. His work has covered several topics related to electrochemical energy storage and management. His work on intercalation compounds in the early 70's (graphite, FeOCl...) was pioneering. An extension of this work resulted in the initial proposition of organic polyquinonic compounds and to carbon-coating of LiFePO₄. Innovative work on polymer electrolytes and plasticizing salts complete the story. He is the author of 250 publications and of more than 150 patents and received a large number of Distinctions and Awards for many years.



**Status on safety of large lithium-ion batteries in Japan, by
Yo Kobayashi, CREIPI, Japan**

Abstract: After the disaster on 3.11, large lithium-ion batteries are highlighted including EV in Japan. Meanwhile, the concept on safety in such batteries is also focused and started the determination in government. I will outline recent activities of large lithium-ion systems for stationary, emergency, and EV in Japan. And, I will introduce about the concept of the cell safety test in the national project. The proposed system is prepared to estimate the maximum latent energy of the cell for PHEV by the forced destruction test.

Biography: Dr. Yo Kobayashi is a Senior Research Scientist of the Sector, Batteries and Electrochemical Materials at Central Research Institute of Electric Power Industry, where he is managing in the development of all-solid-state lithium secondary batteries and also the evaluation study of large batteries for stationary application with renewable energies and for PHEV use in Japanese national project (NEDO). Dr. Yo Kobayashi is also the specialist of Electrochemical Calorimetry, the unique non-destructive analysis approach to lithium secondary batteries. He received the Japanese committee of battery technology award in 2002.



**Risks pertaining to the batteries of electric vehicles : action taken by the civil Safety
Guillaume Dederen, Civil Safety**

Abstract: Since the beginning of the year, the Head Office of the civil Safety has set up two working groups aiming to coordinate the works on the study of eventual risks linked to the batteries of electric vehicles. It means explaining the actions and the objectives of these works, which are the object of much consultation from the state departments, the manufacturers and the concerned institutions.

Biographie: Guillaume Dederen est actuellement Sous-préfet, chef du bureau des risques majeurs. He is presently working at the Sub-Directorate for Planning and Crisis Management, at the Head office of Civil Safety and crisis management on behalf of the Ministry of Interior, Overseas, local authorities and immigration.



**Safety of the battery electric vehicle: a global approach, by
Jean-Yves Le Coz, Renault**

Abstract: The idea is to present a global context showing that safety does not limit itself to the choice made by chemistry, which is undoubtedly a key element, but that it is the result of a system approach that Renault made a point to set up while including the relevant players.

Biography: Jean-Yves LE COZ is a University Professor associated to the National School of Arts and Crafts as well as a MD, specialist in re-education and functional rehabilitation. Biomedical engineer, he graduated from the School of Arts and Crafts and the University of Technology of Compiègne; he worked for 10 years in a clinic in the re-education and functional rehabilitation department for adults and children (Hospitals in and outside Paris). In 1991 Jean-Yves Le Coz joined the research groups of French automobiles manufacturers. Head of the Laboratory for accidents and biomechanics (LAB) for 12 years, he is presently the "Road Safety" leading expert at Renault and Director of the Institute for Sustainable Mobility (IMD) Renault - ParisTech. Legal Expert to the Court of Appeal of Versailles, he won the "National Highway Traffic Safety Administration's Award for Safety Engineering Excellence" by the U.S. administration



**Battery Abuse and Safety Test Procedures for Electric and Hybrid Electric Vehicles –
Review and Analysis, by
Daniel Doughty, Battery Safety Consulting Inc., President**

Abstract: The talk will review US safety standards for batteries in electric drive vehicles. Documents from SAE and Underwriters Laboratories (UL) will be highlighted and compared to other standards where available. The focus will be on safety test requirements and how to ensure safety at the system level.

Biography: Dr. Daniel H. Doughty is president and founder of Battery Safety Consulting Inc., incorporated in April 2008, which focuses on providing expert and independent consulting services for a wide range of battery safety issues. He is active in developing battery safety standards through the Society of Automotive Engineers and Underwriters Laboratories, and has extensive experience in all types of lithium batteries.



Safe status of lithium-ion batteries in Chinese EVs Demonstration and strategies for safety improvement, Xiping Qiu, Professor, Tsinghua University, China

Abstract: In the talk, I will introduce the some safe problems appeared in Chinese EVs demonstration and further to discuss the accident analysis processes. I would also like to talk about the mechanism studies and strategies being considered in improving the safety of Li-ion batteries.

Biography: Dr. Xiping Qiu is a professor of Department of Chemistry of Tsinghua University. His researches are focused on the advanced power sources, such as lithium ion batteries, redox flow batteries, for electric vehicles and electric storage applications. His main research directions include new electrode materials for lithium ion battery, the porous electrode and new techniques for battery characterization. He is now the deputy director of Institute of Physical Chemistry of Tsinghua University and the deputy director of China-US Clean Energy Research Center-Clean Vehicle Consortium (CERC-CVC). He received several Chinese government awards, such as Natural Science Awards from Chinese Ministry of Education and Beijing Municipal Government. He has hold near 30 patents and has more than 130 publications.

