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The project has for objective the improvement of nickel-zinc (NiZn) batteries to be used for stationary applications of energy storage. The constraints of cost, environment and recycling give to the NiZn battery system obvious advantages, as soon as the applications' requirements are met (functioning at high temperature, full charge kept during floating, cycling ...). Domains of applications are back-up systems and systems for storing renewable energies. A small demonstrator will allow to study the coupling "photovoltaic energy - NiZn battery - hydrogen fuel cell". The NiZn battery, the object of this study, was developed by SCPS, partner of the project. The implemented technology allows to free the battery from dendrites formation and from massive redistribution of the negative active mass, problems which made that this system was not able to know a real commercial success so far. The zinc electrode is constituted by a current collector of copper foam and by an active mass into which are incorporated a conductive ceramic and co-additives. This combination, in association with adapted nickel electrodes, allows to obtain more than 1000 cycles at C/3 with a depth of discharge of 80 %, for batteries of industrial size working without maintenance. The participants to ANZAS are universities and industrial partners whose competence allows to bring solutions to meet the objectives of the programme, including qualification tests of the batteries which corresponds to the demand of industrial markets. With for objective to increase the performances of the battery and as alternative to the mixture of powders used presently, the LGMPA will implement surface treatment techniques to coat the zinc oxide, active component of the negative electrodes, with different materials (conductors, materials forming insoluble compounds with zinicates - products of the zinc dissolution -, polymers) while keeping the electric continuity, the integrity and the porosity of the zinc electrode. Post mortem analysis of zinc electrodes made by the LGMPA, the study of the behavior of nickel electrodes in the presence of zinicates, also including post mortem analysis made by the ICG, will allow to better understand the failing modes of the battery and to correct them. SCPS will have in charge the qualifying tests of the zinc electrode materials, as well as the manufacture and preliminary tests of 30 Ah batteries, which are a standard format of experiment. The tests of batteries will be made by SAFT according to specifications targeted at various applications: floating, cyclo-floating, photovoltaic. HELION will study the coupling "NiZn battery-hydrogen fuel cell" with for objective an optimized management of the renewable energies.

SCPS
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Université de Montpellier II – ICG - UMR 5253
HELION
SAFT

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871 847 €
01/12/2008 - 36 months

ANR Funding
ANR-08-STOCK-E-01
**Program: « Energy storage»**

**Edition 2008**

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<tr>
<th>Projec Title</th>
<th>ATESTOC - Aquifer Thermal Energy STOrage to build sustainable village. Location in area of Valenciennes</th>
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<tr>
<td><strong>Abstract</strong></td>
<td>The ATESTOC Project proposes a research program that aims to create a new concept of eco-community, based on aquifer thermal energy storage (ATES) associated with energy producing greenhouse in the city of Aulnoy-Lez-Valenciennes or Fresnes. Despite some experiments in very favourable conditions, the ATES technology remains very little studied and used in France. Several locks linger (technical, environmental and legal). The ATESTOC project will suppress many of these locks. It will also permit to gather success factors of such eco-communities in order to make easier the development of similar project in France, contributing thus to reduce the backlog in this area. It will help to identify the sites which are the most conducive to such facilities. The location of Aulnoy-Lez-Valenciennes has 50 000 square meter of virgin land between the downtown and an old commercial area. The land belongs to the municipality for 90% of the surface and is already available for the experimentation. The site of Fresnes is an alternative to find the best position for the needed aquifer. The prized urban architect wanted to implement an eco-community on this site, using the principle of ATES. Solar radiation is kept in summer through a closed agricultural greenhouse provided with air/water heat exchangers. This energy is stored in an aquifer, and will be used in winter for heating purposes. The electric consumption of the housing and of the greenhouses is provided by an anaerobic digestion unit which treats housing, agricultural and neighbour organic wastes. This unit will also provide the housing with sanitary hot water. The project will be organised in four interconnected studies. It will examine the potentialities of the Aulnoy-Lez-Valenciennes site through a geological and hydro geological study, through the energetic balance of the whole system, exploring the possibilities of urban planning, landscape integration and suitable buildings morphology. The project will review the energetic balance in order to assure a complete autonomy of the eco-community. It will check the sustainability of the ATES on this site, and will study its impact. We will finally develop a decision support tool that may help for other future eco-community projects. This decision support tool shall help to select appropriated sites, and will contain a thermal dimensioning software that allows to calculate the running costs. The project will bring a social dimension by establishing a new agro-industrial activity and creating new jobs. It while bring together the urban and the agricultural worlds.</td>
</tr>
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</table>
| **Partnership** | ESETA  
BRGM  
CTIFL  
EIVP  
ARMINES  
INERIS  
JL COLLET architecte urbaniste |
| **Coordinator** | M. Guillaume GANZEL  
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758 368 €  
01/12/2008 - 36 months |
Program: « Energy storage»
Edition 2008

**Project Title**

**ELOGE 3D - Optimized electrolyte for 3D architecture**

**Abstract**

The expansion of the technology of all solid-state secondary microbatteries on the market of nomad applications (autonomous sensors, RFID tags ...) is limited by the need of increased integration: to decrease dimensions but to maintain high performances. The solution consists into increase the active surface of the component. The actual planar microbatteries have to be replaced by a new generation of 3D microbatteries; this architecture will increase by 5 to 10 the batteries power density (from 5mW/cm² to 50mW/cm²).

The targeted applications are all-solid-states microbatteries with a high capacity per surface unit on patterned substrates, called 3D and microsystems incorporating them as power sources.

The technological barrier is the deposition process of microbatteries actives layers. Indeed, the PVD process widely used for 2D batteries is incompatible with thin film deposition on substrate with high aspect ratio.

The goal of the project is to deposit an inorganic lithiated electrolyte thin film on 3D substrates by the way of a new deposition method permitting to obtain conformal layers on these substrates.

The most innovating point is the new deposition process compatible with the 3D architecture required for the capacity enhancement and opening the way of 3D microbatteries manufacturing. The scientific outcomes are the understanding of CVD mechanisms for lithiated electrolyte layers deposition and the influence of the physical and chemical properties on the electrochemical performances of electrolytes layers. The technological break focuses on the deposition process which will permit the conformal layers deposition for high power density batteries and to increase the deposition rate to reduce the production cost.

The results will reinforce a competitive position of France on the high power density energy devices market. This project is confidential.

**Partnership**

CEA/LITEN
INP Grenoble – LMGP - UMR 5628
Université Paul Sabatier de Toulouse - LAPLACE - UMR 5213
STMicroelectronics – Tours
ANNEALSYS
BIOPHY RESEARCH

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01/12/2008 - 36 months

**ANR Funding**

ANR-08-STOCK-E-03
### Project Title

**ESSI - Assessement for seasonnal storage systems**

### Abstract

This project aim to evaluate and to compare various processes for long-term thermal energy storage: solid sorption, liquid absorption, latent heat, sensible heat. The first process (solid/gas sorption) will be developed and experimented in this project, the assessment of the other processes will use results from related projects.

Thermochemical systems can suit to a large range of applications, at various storage temperature (50° C to 1000° C) and functionality (heat or cold production, heat upgrading). However, in order to compare them with the other systems, we focus this project on a common target that can be reached by all the technologies and is a key-point with regard to the greenhouse gas emissions. The study is thus limited to seasonnal storage of solar energy for domestic heating. We plan to experiment a high energy density solid/gas reactor (target: 500 kWh/m3), for a storage temperature of 50° C, in a significant size (about 1/10).

By means of semi-virtual experiments, carried out with an accelerated experimental mode, we will get experimental data for various climatic conditions, and be able to validate the model of the thermochemical system. The comparison with the other systems will then be carried out by simulating of whole system: solar collectors/storage/dwelling.

After a first step to define of the target performances of the storage system, this project consist of two main phases.

The first one lasts 30 months and focuses on the optimal sizing of the thermochemical system. It involves the two main partners of the project: PROMES, for its expertise in thermochemical processes, and the CEA at INES, for the evaluation of solar systems. The CEA at INES will define the accelerated mode for experiments to be carried out. The prototype will be sized according to these informations. It will be built by PROMES, and experimented by CEA at INES.

In addition to this experimental part, this step includes a fundamental research part related to on one hand the mass and heat transfers within a high density porous medium, and on the other hand on two configurations of the thermochemical process: either a traditional process made up of a solid/gas reactor connected to an evaporator and condenser, or an 'open process', involving only one solid/gas reactor reacting directly with humid air. Thus, this second process is simpler.

In both cases, the optimization of the reactor necessitates a 2D modelling, coupling heat and mass transfers and chemical kinetics within the reactive material. This step needs will use transfer parameters measured on the measurement bench of characterization, for densities of material which were never tested before. Both volume and energy density resulting from the target performances, the optimisation parameters are the geometry of the reactor and the diffuser network.

A second 18 month step will then deal with the performances assessment and the comparison of the various systems. Three other partners will be involved here: LOCIE (Liquid absorption), LaTEP (latent heat) and DOMINGUEZ Energie (sensible heat). They will provide numerical models, being validated from their related projects. Hence, each partner will size a system according to the target performances. Each system will be assessed through dynamic simulation for various climate and dwellings.

The objective is to defined, for each system, the pertinent field of application. This will be performed by using several criteria as energy performance, complexity, and cost assessment.
| **Partnership** | CNRS DR13 – PROMES  
CEA INES - UPR 8521  
Université de Savoie - LOCIE - EA 3704  
Université de Pau et des Pays de l'Adour - LaTEP - EA 1932  
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| **ANR Funding** | 747 862 €  
01/12/2008 - 48 months |
| **Beginning & duration** |  
Reference |  
ANR-08-STOCK-E-04 |
**Program: « Energy storage»**  
Edition 2008

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<th>Projec Title</th>
<th>INTERFACE 5V - Study and stabilization of the electrode/electrolyte interface at high voltage</th>
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<tr>
<td><strong>Abstract</strong></td>
<td>Li-ion batteries are already used in many nomad applications, but improvement of this technology is still necessary to be (durably) introduced on new markets such as EVs or HEVs. Modification of the nature of the electrode materials is the most challenging and innovative aspect. One of the possible breakthroughs should consist in the use of high voltage materials at the positive electrode to enhance the cell energy density. Spinel oxides with the generic composition 'LiNi0.5Mn1.5O4' have redox potential at 4.7V vs. Li+/Li corresponding to the Ni2+/Ni4+ couple. The synthesis and composition of these materials has been optimized for the last years. At the opposite, no solution for proposing stable electrolyte above 4.2-4.5V vs. Li+/Li has been found yet. Conventional electrolytes, like LiPF6 salt dissolved in carbonate mixtures, give reactive electrode/electrolyte interface at high voltages. In consequences, the self-discharge is rapid, preventing a commercial use of these materials. With the aim to develop high voltage Li-ion batteries, this project will focus on the study of the electrode/electrolyte interface for uncommon potentials, above the limit of stability of present electrolytes. To solve the problem of electrolyte instability at high voltage, we intend to follow two (complementary) approaches. The first one will consist in the use of additives in the electrolyte to protect the interface (same approach as for the graphite electrode during the last decade). The second approach will be dedicated to the replacement of conventional liquid carbonates with new fluorinated solvents (salt is far more stable than solvents at high voltage). This will be developed by CEA, LEPMI and RHODIA with the priceless help of IMN, ICMMO and IPREM for complete characterization of the interfacial phenomenon by TEM, NMR, impedance spectroscopy and XPS. In order to prevent side reactions with graphite electrode at low voltage, the selection of the best solution(s) will be obtain on the redox system LiNi0.4Mn1.6O4/Li4Ti5O12, already developed at CEA (except for electrolyte). Li4Ti5O12 (1.55V vs. Li+/Li) is considered as a very promising active material for high power Li-ion cells, but energy density is low when it is combined with conventional positive electrode at ‘4V’. The LiNi0.4Mn1.6O4/graphite system will be investigated in parallel, especially during the last year of the project, to prove the interest in the new electrolyte for '5V' batteries. The researches we intend to perform during this project are motivated by industrial interests. PSA will participate to this project and will evaluate the solution proposed by the partners. In conclusion, the 'Interface 5V' project proposes to solve the problem of interface reactivity at high voltage. Advances on additives and/or new fluorinated solvents for electrolyte should allow to prepare high power and high energy Li-ion batteries.</td>
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**Partnership**  
CEA/LITEN  
CNRS – LEPMI - UMR 5631  
CNRS DR17 – IMN - UMR 6502  
Université Paris Sud XI - ICMMO - UMR 8182  
Université de Pau et des Pays de l'Adour - IPREM - UMR 5254  
RHODIA Operations  
PCA SA

**Coordinator**  
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ANR Funding  
862 989 €  
Beginning & duration  
01/12/2008 - 36 months
SETHER - High temperature thermal electricity storage

SETHER project consists in leading all the preliminary R&D works to implement an innovative technology of large-scale thermal storage of electricity.

This technology, developed and patented by Saipem, is based on an innovative energy storage process that represents a technical gap for large-scale electricity storage solution. The studied storage process is based on a thermodynamical cycle, during which the system is loaded by using electricity to produce thermal energy that is accumulated in refractory materials raised to high temperature (around 800°C), then unloaded when there is a need for electricity.

The facility includes two pressurised enclosures made up of solid beds (one high temperature enclosure and one low temperature enclosure) linked together by turbomachineries. During loading phase, electricity is used to transfer heat from the low temperature enclosure to the high temperature enclosure thanks to a heat pump that makes an inert gas circulating in a closed loop. During unloading phase, the thermal transfer between the high temperature enclosure and the low temperature one is converted into mechanical energy by thermal machinery (turbine-compressor system) that drives a generator producing electricity.

This storage process is highly efficient over a cycle, thanks to the use of a heat pump for loading, compensating for the low efficiency of the conversion from thermal energy to mechanical energy while unloading. This system allows thus to get a load/unload cycle efficiency independent from Carnot efficiency. According to preliminary studies, 70% global efficiency is possible for parameters consistent with current turbines and compressors. This system presents major economic, industrial and environmental advantages. It fits particularly for large-scale grid-connected storage (typical storage capacity from 100 MWh to 1000 MWh, several hours cycle), with high storage density.

Moreover, as the system does not need specific characteristics for localization, it can be advantageously located in the most adapted sites, notably close to consumption areas. Based on preliminary assessments of investment and operating costs of the components of the system, the global storage cost can be evaluated between 20€ and 40€ per MWh and may benefit from strong scale effects on price, making several economical industrial applications conceivable.

Moreover, the process (operating in closed loop) will be environmentally friendly and efficient from a life-cycle viewpoint. Preliminary scientific studies have been lead by Saipem and the first results of the system modelling have confirmed the economic interest of the storage, notably in terms of efficiency improvement. These first results need to be confirmed by more extensive research works that will be realised during SETHER project.

From a technological viewpoint, the appropriate refractory materials, turbines and compressors exist, but their specific implementation to the process needs industrial developments. SETHER project, coordinated by POWEO – an integrated industrial energy company, interested in the development of this technology – will include industrial R&D works about the process and about the whole technologies necessary to design industrial facilities putting it into application.

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<td>POWEO SA</td>
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<td>SAIPEM SA</td>
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<td>CEA/LITEN</td>
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| **Coordinator**         | ENSCI – GEMH - EA 3178  
ONERA  
CNAM Laboratoire de Génie des procédés pour l'environnement, l'énergie et la santé - EA 21  
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| **ANR Funding**        | ANR-08-STOCK-E-06  
780 566 €  
01/12/2008 - 36 months |
| **Beginning & duration** |                                                                                |
| **Reference**          |                                                                                  |
SOLARGEOTHERM - Supervised rock-mass storage and release of thermal energy produced by a solar power unit

The use of solar thermal collectors provides a very intermittent heat production that is time offset with respect to requirement. The project will therefore study and model the possibility of storing this energy in a rock massif. The project will endeavor to assess the potential capacity of rock massifs to store and release thermal energy produced by a solar plant. The heat transfer to the rock mass will be assured by geothermal probes. This will be done through a fully regulated control of the storage and release parameters free from the interference of any parasite use. The parametering freedom will allow experimental designs in preparation for best-condition modeling of both the thermal behavior of the rock massif and the probe-massif exchanges. Optimization of the probe-massif thermal exchanges and equilibrium of the exchanges with time will notably be studied by parametering the storage-release intervals, and not necessarily interseasonally. The project will consider a study site in homogeneous geological rock away from any aquifer and subsurface water circulation in fracture network. The study site will be equipped with three geothermal probes in wells 200 metres deep set next to each other, 40 m² of solar thermal collectors and dry-coolers as heat sink devices. A detailed geological study on rock fracture will be performed by well diagraphy and surface geophysics. Thermophysical parameters of the rock-mass will be determined based on core samples and testing the in situ thermal response of the rock mass system. The modeling of the thermal behavior of the rock mass and the probe / rock mass heat transfer will be done and the calibration of the models set upon the data base collected by the project within experimental designs schemes. The project duration is 36 months. The task of monitoring the heat storage and release will be conducted over two complete annual cycles. The study site will be prepared in the Pyrénées-Orientales. It should be noted that the study site will be selected close to public facilities that the probes and solar thermal collectors can possibly be reused by these facilities at the end of the project. At the end of the project, good practice guidelines will be written up for consultancy firms, setting out the optimal characteristics required for a rock massif to be usable for storing thermal energy produced by a solar plant: i.e. the geological nature and volume of the concerned rock massif, modeling according to the geological environment, depth of thermal-energy injection probes, quantity of thermal energy that can be stored, optimum thermal-energy storage and release dynamics. The project will have no environmental impact on aquifers, the heat storage being done outside of the aquifer environment —the water resource is not exposed. The transfer of heat from the ground by geothermal probe is a proven technical mechanism, with no risk of the system plugging or corroding and no environmental contamination. Our project is directly involved in the approach to reducing the CO2 emission of the residential sector, notably in the will to use a thermal energy that is widely available and free (although out of phase with heating needs), to store it (notably inter-seasonally), and to recover it when the need is felt for the buildings to be heated. Basement areas (approximately 40% of Metropolitan France) are concerned by this possible use of a rock mass as a low-temperature heat reservoir. One can also consider arid regions where the aquifers are at a depth of several hundred metres, with the possibility of rock-mass storage at medium depth of calories or frigories.
<table>
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<tr>
<th>Coordinator</th>
<th>DOMINGUEZ ENERGIE CNRS DR 13 Montpellier – PROMES - UPR 8521 M. Denis NGUYEN <a href="mailto:d.nguyen@brgm.fr">d.nguyen@brgm.fr</a></th>
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<td>Beginning &amp; duration</td>
<td>01/12/2008 - 36 months</td>
</tr>
<tr>
<td>Reference</td>
<td>ANR-08-STOCK-E-08</td>
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**Project Title**

SUPECCO - Supercapacitor Electrodes based on Conductive Cobalt Oxides

**Abstract**

The fundamental research project proposed here concerns the field of new hybrid C/transition metal oxide supercapacitors. Many research works are presently devoted to the C/MnO2 system, which is particularly interesting because it is working in aqueous medium at potentials that can reach 2 V, and also for its high stability in ageing. Nevertheless, this system suffers from the poor electronic conductivity of MnO2, which limits the performances. Any research work aiming at improving the oxide conductivity is therefore interesting and promising. We propose in this field to develop new supercapacitor electrodes, based on original conductive cobalt oxides, containing lithium and hydrogen within the structure. In these original phases, which were first designed for the positive electrode of Ni-MH batteries, the presence of tetravalent cobalt entails a high electronic conductivity (10^-1 à 10^-2 S.cm^-1 at room temperature). Such materials can be easily prepared as particles exhibiting nanometric dimensions, which is suitable for making electrodes by mixing with an organic binder, with or without a carbon black. Chemical coating of the conductive cobalt phases on the surface of metallic nickel nanorods is also planned, which should constitute interesting electrodes. This process should allow to decrease the amount of cobalt involved in order to reduce cost. The performances of these overall electrodes will be evaluated and the mechanisms occurring at the material scale will be studied. Last but not least, C/Co3O4 complete cells will be tested.

**Partnership**

CNRS - DR Aquitaine Limousin – ICMCB - UPR 9048
Université Paul Sabatier-CIRIMAT - UMR 5085

**Coordinator**

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**ANR Funding**

210 940 €

**Beginning & duration**

01/12/2008 - 36 months

**Reference**

ANR-08-STOCK-E-09
## Abstract

There is no really satisfying solution for a compact and light pulsed power supply for applications such as FACTS or electromagnetic launchers. The superconducting magnetic storage known by its acronym SMES (Superconducting Magnetic Energy Storage) with high critical temperature superconductors (HTS) offers favourable characteristics for this application. In addition to their large transport current capacities under high magnetic flux densities, the operation at higher temperatures of the HTS removes the limit given by the stability for conventional superconductors. However the protection of magnets with HTS (High-Tc magnet) is identified as an issue. The main purpose of the "SUPER SMES" project is to develop the technology of High-Tc magnet dedicated to SMES with a high energy mass density. The goal is to at least double the present value which is about 10 kJ/kg. This involves the development of high-field magnets with a "light", but strong mechanical structure to support the huge Lorentz forces. HTS dedicated cables will be developed as well. The mechanical design of the cables and magnet is one of the challenges of the project since mechanical constraints remain the ultimate theoretical limit in terms of specific energy for a SMES. The inner element of the magnet is the most critical part since it experiences the maximum stresses. We want to bring a decisive contribution to the present issue of the protection of high-Tc magnets. Experiments combined with modelling will be carried out to deeply understand the involved phenomena and propose several scenarios for an effective protection. For cable, we intend to develop a cable in conduit with HTS. This type of cable meets the requirements of high-currents, stress support very closed to the conductors and an easy way for electrical isolation required for high power SMES. Our approach combines experimental and design aspects via numerical modelling. A crucial point is the characterization of the properties: current transport, AC losses and mechanical stresses in particular. Conductors will be the 1st or 2nd generation. One of the aims is the selection of the most suitable conductor for SMES. The operating temperature is one of the parameters to be optimized for this application. An important point is the validation and qualification of proposed solutions by the realization and the tests of several highly instrumented coils. These coils will be tested under high magnetic flux densities (up to 20 T) to replicate the operational conditions for the most critical part of a high Tc high field magnet. The analysis of the tests will lead to an optimisation of the design. All these studies will use the skills and expertise of the partners that bring together diverse and complementary skills, both academic and industrial. The high-Tc SMES 800 kJ DGA-Nexans-CNRS is a key element to start the project. The main deliverable corresponds to all the models, technological validated solutions and the superconducting dedicated cable for High Tc SMES with high performances in terms of mass for pulsed power supply.

## Partnership

| CNRS - CRETA - UPS 2070 |
| CNRS - LCMI - UPR 5021 |
| CEA - IRFU |
| NEXANS France SAS | Pascal.Tixador@grenoble.cnrs.fr |

## Coordinator

M. Pascal TIXADOR

## ANR Funding

| 651 403 € |
| 01/12/2008 - 36 months |
| ANR-08-STOCK-E-10 |
Program: « Energy storage»
Edition 2008

**Projec Title**

VITFER - Flywheele for railway transportation

**Abstract**

The embedded energy storage is solution which present many advantages for energy consumption reduction and for environment aspects. The state of art of energy storage systems shows that many technologies are possible (super-capacitors, batteries, flywheels, ...). These technologies are not all at the same level of maturity and by consequence for industry application and they present different characteristics and each system exhibit advantages and drawbacks. With energy, power, lifetime and possession cost adapted to railway applications, the flywheel technology represents a prometeous solution et can reach industriel state very quickly as demonstrated by laboratory experimentations and some applications on vehicle. However, as the emergent technology, the flywheel with high speed characteristics is so far from an industrial equipment allowing reliability and lifetime, ..., et by consequence able to be installed on vehicles commercially operating. For thus, some important progression margins are also available and must be used particularly at system level. An integration strategy of functions as electric motor and power electronic can give more reliability and increase the system performances. The volume freed by this integration can be used to put more energy embedded.

After, some tests was done on Rotterdam Tramway using flywheel prototype system, ALSTOM launch VITFER R&D program to develop the needed technologies for flywheel destined to energy storage system for railway application. In the context of VPE-PREDIT call of projects (April 2006), a first phase of this big project have receiving a financial support for 24 months. This first phase is dedicated to base studies, calculation tools development to evaluate performances and to design the flywheel system. At this stage of study, we identify the following critical issues:

- lifetime of composites including fatigue
- design rules for composites are not stated for mobile application
- failures modes of the composites rotor as an assembly (metallic and composites parts) is not well known
- limitation of actual flywheel system to demonstration
- thermal aspects of flywheel and integrated electrical machine is a key issue for operation mastering and safety. The requirement for "energy storage" must be associated to needed power to charge system. This requirement is implying more interation between flywheel and electrical machine.

The project propose to adress these critical issues with product development vision in the mid term (4 to 5 years). For this, the projet is composed by a relevant partennesship (industrial companies and research laboratories), the global cohesion is insured by ALSTOM.

**Partnership**

ALSTOM TRANSPORT S.A.
Netherlands\ CCM (Centre for Concepts in Mechatronics)
ADAC (Sté Anonyme Dauphinoise d'Applications Chimiques)
Université de Franche-Comté - FEMTO-ENISYS - UMR 6174
Université de Franche-Comté - FEMTO-DMA - UMR 6174

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**ANR Funding**

1 795 550 €
01/12/2008 - 36 months

**Reference**

ANR-08-STOCK-E-07