



Direction de la Recherche

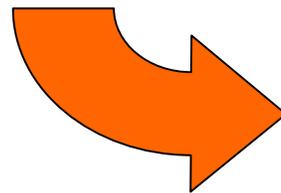
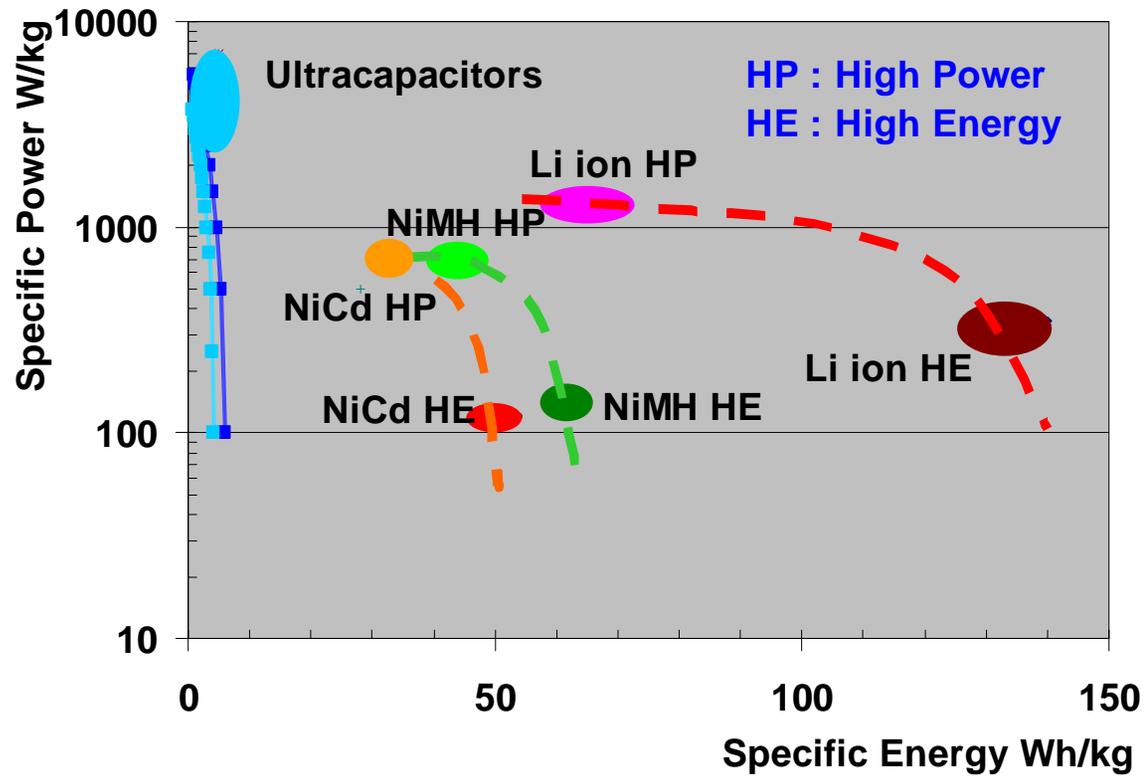
SAFT
3500 F Ultracapacitors



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Date : 28/3/2001

- ◆ **High current : fast discharge and fast charge**
- ◆ **Cycle life : several millions cycles**
- ◆ **Low temperatures : down to -45°C**
- ◆ **Performance in abusive tests**

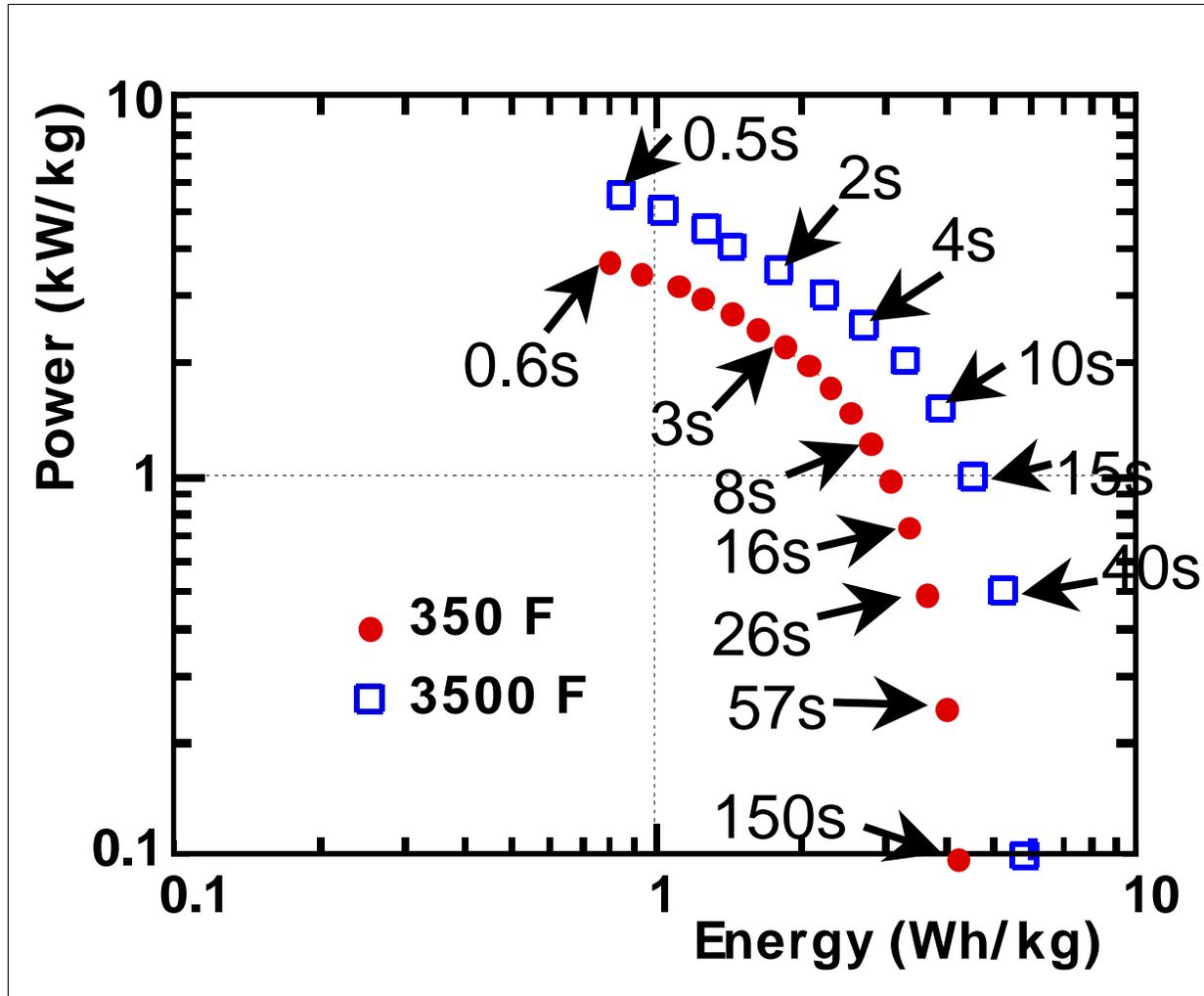
Comparison with accumulators



High Power
Low Energy

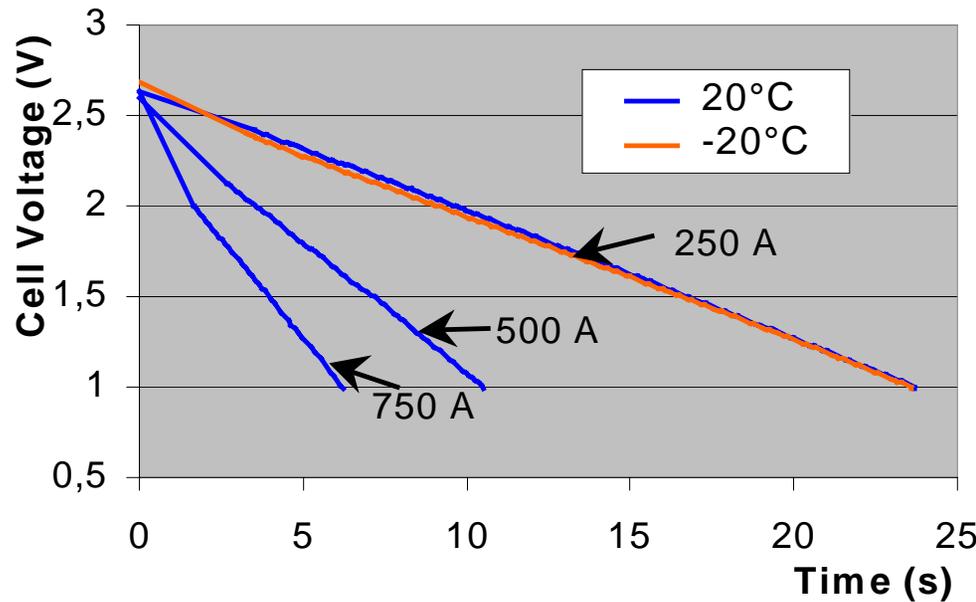


- ◆ **Definition of the electrochemistry based on our R&D previous experience**
 - ◆ **Use of a new carbon material to improve fading and self-discharge (lower surface area, lower F/g but same F/cc and better processability)**
- ◆ **Synergies with lithium-ion**
 - ◆ **Mechanical design : use of aluminum container and design used in HE lithium-ion**
 - ◆ **Process : similar to lithium-ion carbon electrode**
- ◆ **Modifications specific to the technology**
 - ◆ **Adaptation and redesign of the cell terminals, seals and current collection mode.**
 - ◆ **Completely symmetrical design**



- ◆ 10 - 15 s is generally the optimum time frame.
- ◆ But it is very dependent on the mission profile

◆ **High rate and low temperature behavior**



Efficiency during discharge

250 A : 93%

750 A : 81 %

Efficiency charge/discharge

at 250A : 90 % at 20°C and - 20°C

Discharges up to 1000 A.

Same behavior for high rate charges and discharges

No effect of temperature down to -20 °C

At -45°C, 50% of the power still available

**Diesel starting
Cold temperature starting
Regenerative braking**

◆ Power Sources for :

- ◆ **Public transportations (train, tramways, hybrid buses, “tram/train”):
Starting, acceleration, regenerative braking...**
- ◆ **Stand-by : back-up power for 10s shortage, for compensation of voltage sags**
- ◆ **Actuators : replacement of hydraulic or pneumatic systems**
- ◆ **Military and space specific applications**
- ◆ **Automotive : starter for diesel engines, 42V in association with energy batteries**