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Sigma cells

PATENTS 14 PATENTS

All-in-one inverter, charger and advanced battery management system for enhanced e-mobilitys

What is Sigma Cells?

Sigma Cells, CEA-Leti's switched cell technology, is revolutionizing the world of batteries for e-transportation revisiting the traditional architectures and taking the multi-cells power source as a key advantage to bring a disruptive solution featuring:

- Improved power conversion efficiency
- Fast charging at no additional cost
- Less bulky and lighter batteries
- Reduced pollution: currently, if only one cell fails, the entire battery is down
- Contraintless electrical vehicle architecture
- Simplified diagnostic & maintenance

Sigma Cells allows smart use of battery cells—the battery brains, by:

- Ensuring continuity of service in the event of sudden cell failure by finding an alternative "safe route"
- Leveraging the "best" cells at a time to ensure longer autonomy and a power reserve

Applications

Sigma Cells is designed for e-mobility applications regardless of the power size: for example e-cars, e-bicycles, e-buses, etc.

Sigma Cells can also be leveraged for storage applications, among others:

- Network regulation
- Server supply
- Nomadik power banks
- Power tools supplies
- Autonomous building…

What's new?

With e-mobility coming down the road, Sigma Cells addresses tomorrow's massive demand for power conversion and efficiency. Here is what's new:

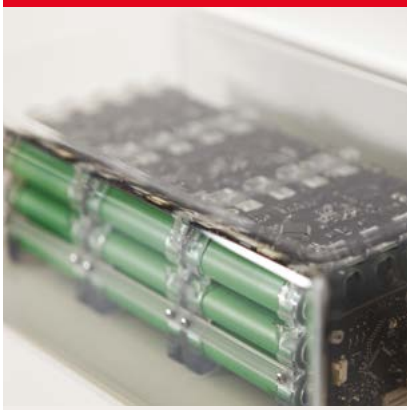
- **Inverter function**: provides a direct motor drive from the battery pack providing a waveform in line with the motor speed, torque and power
- **Integrated fast charger**: bidirectional system (current and voltage) enabling a direct recharge on the electrical network
- **Advanced BMS** with individual and continuous access to any cell unit:
  - reducing SoC and SoH error estimation by a factor 2
  - improving autonomy of 20%
  - improving life time of 15%
- **Enhanced performances** thanks to native low voltage switching (~3.6 V) compared to a classical inverter switching the full battery pack voltage (~400 V):
  - reducing drastically the switching losses by 100
  - reducing the need for cooling
  - reducing drastically the CEM emission by 100

What's next?

CEA-Leti is working hand-in-hand with industrials to prepare the upcoming e-mobility boom. Researchers are currently working towards enhanced systems and dedicated hardware and software for the automotive industry.

Key facts

- "Performance Analysis of a Novel High Frequency Self-Reconfigurable Battery", R.Thomas, F.Lehmann, J.Blatter, G.Despesse, V.Heiries World Electr. Veh. J. 2021, 12, 10. https://doi.org/10.3390/wevj12010010
- A High Frequency Self-Reconfigurable Battery for Arbitrary Waveform Generation, R.Thomas, G.Despesse, S.Bacquet, E.Fernandez, Y.Lopez, P.Ramahefa-Andry, L.Cassarino World Electr. Veh. J. 2021, 12, 8. https://doi.org/10.3390/wevj12010008



Interested in this technology?

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