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cea leti

Sigma Cells

PATENTS 26 PATENTS

All-in-one advanced battery management, inverter, and bidirectional charger

What it is

CEA-Leti's Sigma Cells switched-battery-cell technology supports batteries in their key role in the "electrification of everything" era by making them smarter, more compact, and more efficient.

The technology's main advantage is that each 3.6 V to 48 V cell can be switched on and off individually, opening the door to a range of new capabilities. Faulty cells can be bypassed to improve battery uptime, and each cell can be turned on and off as needed to correct the current or adjust the output voltage.

What it can do

Sigma Cells is an all-in-one battery system that performs three functions:

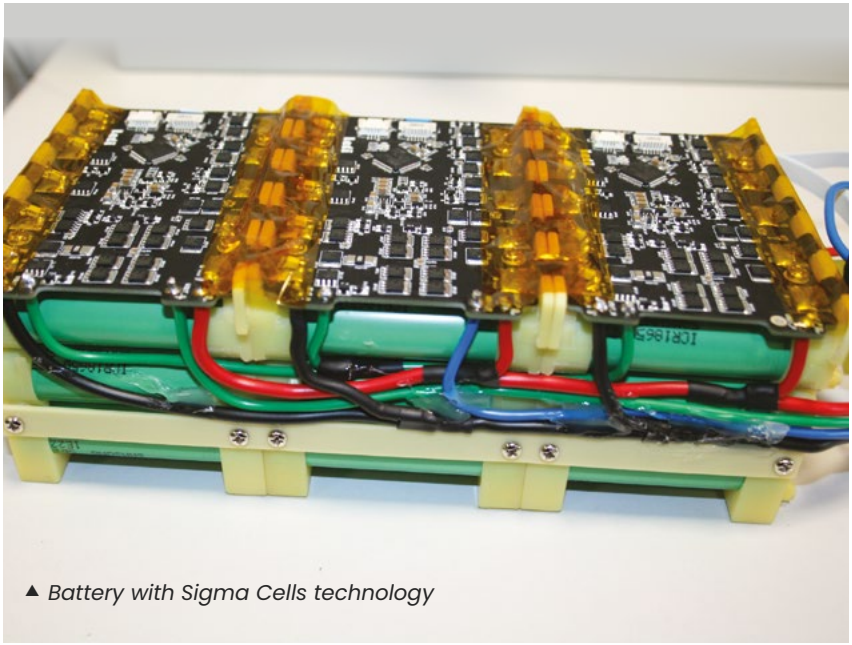
- **Inverter**: Serves as a variable speed drive for precision motor control. Frequency and voltage to the motor are adjusted automatically, improving efficiency and motor lifespans.
- **Fast charger**: Vehicles equipped with the battery can get the same fast charging delivered by electric vehicle charging terminals from any standard electrical outlet. Bidirectional functionality allows energy to be injected back into the grid for X2G connectivity.
- **Advanced battery management system (BMS)**: Cell-by-cell management allows individual adjustment of current, voltage, temperature or state of charge while providing the requested voltage at the battery pack output.

The technology is ideal for electric vehicles and stationary energy storage for solar and other renewable energy production systems. However, it can also be used to electrify a wide range of equipment like cordless tools, mobile power banks, servers, off-grid buildings, electric bikes, roller shutters, and more.

What makes it unique

Sigma Cells is universal, enabling power-on-demand. This reliability-enhancing solution offers dynamic, cell-by-cell switching for batteries that are lighter in weight, more compact, and longer lasting. It also:

- Eliminates the need for liquid cooling systems, for electric vehicles that are simpler and more cost-effective to manufacture, lighter in weight, and easier to maintain during operation.
- Helps electric motors operate more efficiently, for less maintenance and longer lifespans.
- Enables grid connectivity through bidirectional charging.



▲ *Battery with Sigma Cells technology*

Key facts

- 15% more range for EVs
- 20% longer battery life
- 15% longer service life and easier second-life reuse
- 100X reduction in switching losses
- 15% lighter weight

▲ *30 kW stationary storage system with Sigma Cells all-in-one charger, inverter, and BMS*

What's next

Sigma Cells has already been deployed in low-power systems like electric roller shutters. It can also be used to generate very stable voltage for sensitive loads like computing servers. For power ratings compatible with automotive use cases, the technology is at a TRL of 6-8 and is ready for joint development to manufacturer specifications. Heavy-transportation-grade capabilities are already under development.

Interested in this technology?

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