Electronic Design

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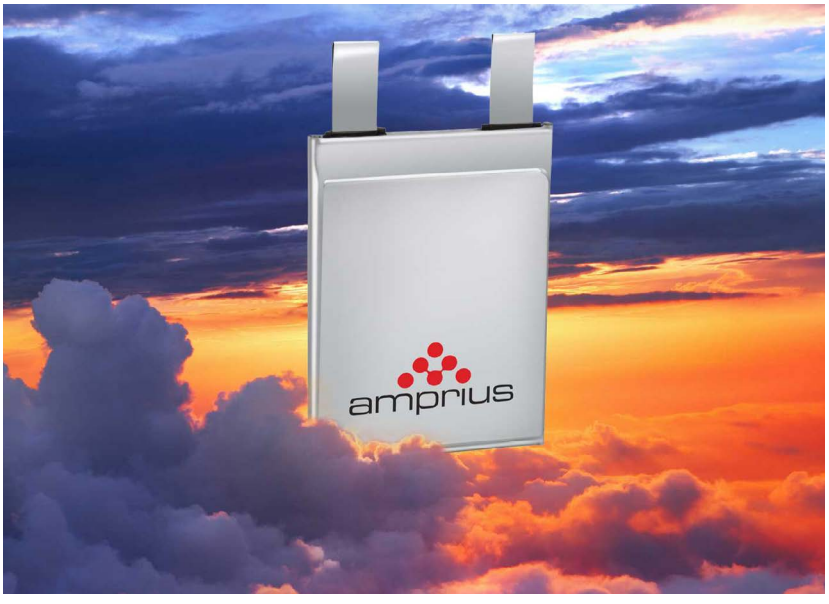
This New Lithium Cell Tech May Put SpaceX Out of Business

Amprius announced fourth-quarter production of a 500-Wh/kg battery cell aimed at stratosphere-based communications UAS, which may render SpaceX's LEO satellites obsolete.

Amprius Technologies Inc. introduced its second-generation SiCore battery platform. The silicon-anode lithium-ion cell is rated at 500 Wh/kg for uncrewed electric aviation systems (UAS) and other applications where battery mass directly limits mission endurance.

According to the company, the SiCore 500 cell achieves that specific-energy figure at a continuous 1C discharge rate and, crucially, can be built using conventional lithium-ion manufacturing equipment. Commercial availability is expected in the fourth quarter of 2026.



The Amprius 500 cell, in its pouch form is destined for use in uncrewed aircraft loitering in the stratosphere to act as fixed-location communication nodes, unlike LEO satellites. @Source Info: Amprius @Credit: Amprius

Reaching 500 Wh/kg is a notable performance milestone, particularly for high-altitude platform stations (HAPS), fixed-wing drones, and other aircraft designed to remain aloft for days or months. But the more important claim may be manufacturability: Amprius previously demonstrated cells at or above that energy density, though those products relied on specialized processes and did not reach commercial-scale production.

The newer SiCore platform is intended to change that equation. Instead of requiring purpose-built manufacturing lines or unusual cell constructions, the company said its second-generation product is compatible with established lithium-ion processes, equipment, and form factors. That approach potentially lets Amprius use its existing contract-manufacturing partners to ramp volume production while avoiding the capital burden of building new dedicated factories.

Silicon Supplement

Amprius' method replaces or substantially supplements the graphite normally used in a lithium-ion battery's anode with silicon. Silicon can store far more lithium per unit mass than graphite during charging. Its theoretical gravimetric capacity is roughly 3,600 mA/g versus 372 mA/g for graphite. That doesn't translate directly into a nearly tenfold improvement at the cell level because cathode materials, electrolyte,

current collectors, packaging, and inactive components all contribute mass to a cell.

Notwithstanding the pesky real-world realities of battery-cell construction, a higher-capacity anode can reduce the amount of anode material needed for a given energy target. It also allows more of the cell's total mass and volume to support energy storage.

The engineering challenge is that silicon expands substantially as it alloys with lithium during charging — somewhere around 300%. Repeated expansion and contraction can fracture the anode, disrupt electrical paths, and will continually rebuild the solid-electrolyte interphase, consuming lithium and degrading capacity.

Therefore, silicon-anode battery developers must manage particle and electrode design, coatings, binders, electrolyte chemistry, and manufacturing processes to preserve cycle life and safety while extracting the inherent energy-density benefit.

For long-endurance aircraft, the tradeoff is straightforward: Every kilogram removed from the energy-storage system can be reassigned most critically to payload, but also to propulsion margin or for providing additional energy. At altitude, where solar-powered loitering aircraft must store enough electricity during daylight to fly through the night, gains in specific energy can have an outsized effect on endurance and in the amount and type of communications payload that's able to be carried.

New Cell Likely Bound for HAPS and Fixed-Wing Uncrewed Aircraft

Amprius designed the 500-Wh/kg cell around sustained, lower-rate, discharge conditions rather than for high-power bursts. That makes it a closer fit for HAPS and fixed-wing uncrewed aircraft than for applications that prioritize the rapid acceleration or high peak current as was needed for the recent DARPA Lift Challenge.

The company already supplies batteries for AALTO's Zephyr HAPS program, a solar-electric aircraft platform developed by Airbus SE subsidiary AALTO. Zephyr reported a flight endurance record exceeding 67 days a bit over a year ago, only limited by battery-charge cycle life.

Such sustainable, clean, and self-sufficient, solar-powered, high-altitude aircraft platforms are being positioned for missions including persistent communications coverage. It's a significant market that SpaceX is trying to address with expendable, incinerate-it-all-in-the-corporate-atmospheric-toilet, LEO Starlink satellites and tens of thousands of methane-guzzling and CO_2-spewing Starship rocket launches per year, as well as for Earth observation. Amazon has similar ambitions and strategies for LEO satellites as SpaceX, though at a much smaller scale.

Initial SiCore 500 production is planned for Amprius's Fremont, Ca., facility. The cells will be offered in customer-specific packages as well as the standard small-UAS pouch-cell form factor defined by SAE JA1016 *(see figure)*.

@@FigureFile: Figure 1

Higher-volume production is expected to move through the company's global contract-manufacturing network by year-end 2026.

To comprehend the very significant impact of this 500-Wh/kg battery cell technology announcement, understanding its key application and market size is crucial. This YouTube video shows the highly impactful core application for the Amprius 500 cells that reduces humanity's communications carbon footprint and could threaten SpaceX's LEO satellite Starlink business. It could subsequently lead to a certain former trillionaire's bank loans getting called in if his stock market equities collateral becomes completely worthless.