

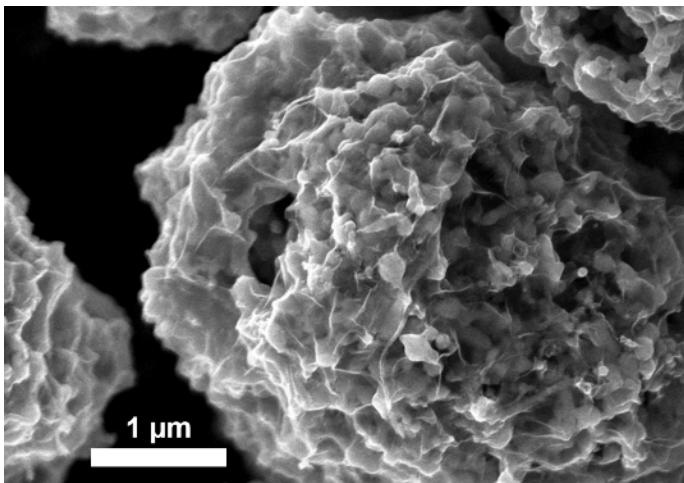


GRAPHENE-SILICON COMPOSITE ANODE (GCA™)

Global Graphene Group (G³) offers a significant advancement to current lithium-ion battery (LiB) technology. Our high capacity graphene-silicon composite anode (GCA™) is compatible for use in LiBs for small format consumer electronics (3C industry) and large format electric vehicles (EVs). GCA™ can be tailored depending on customer requirements for high energy or high power application.

APPLICATIONS

- EV, HEV, PHEV 3C
- Industry Drone
- Aircraft
- Stationary energy storage



Micrograph of GCA™ Secondary Particle

FEATURES

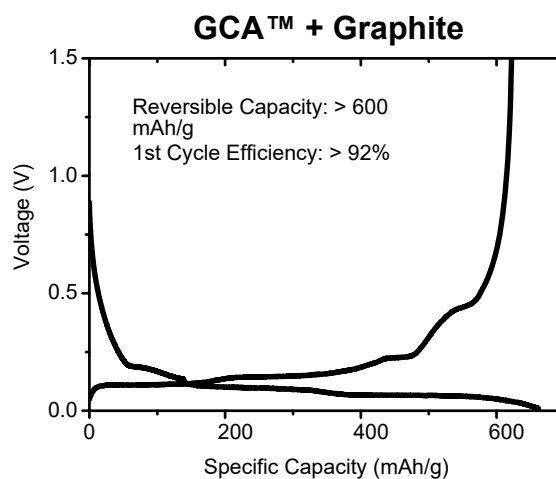
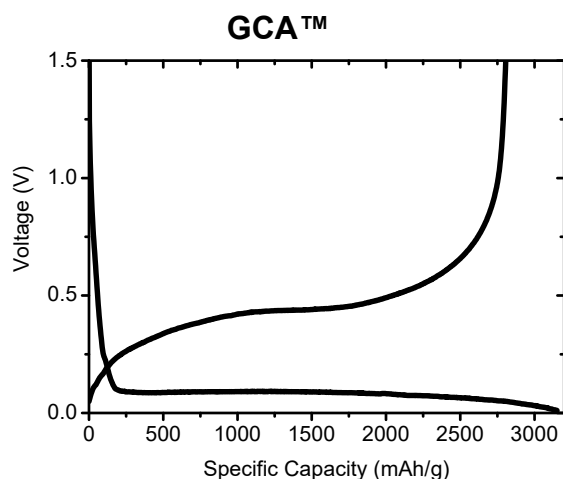
- Spherical morphology
- Nano-silicon (non-CVD)
- High reversible capacity and high FCE
- Efficient Li-ion storage
- Compatible with most aqueous binders
- Easily blended with various forms of graphite

Typical properties	Units	GCA™	GCA™ + Graphite†	Commercial Graphite
Particle Size D ₅₀	μm	3 - 15 (tunable)	10 - 20	10 - 20
Specific surface area by BET	m ² /g	5 - 25 (tunable)	2 - 7	1 - 5
Specific capacity	mAh/g	1500 - 2800	550 - 800	340 - 360
First cycle efficiency	%	> 89	90 - 92	90 - 94
Packing density	g/cm ³	> 1.0	1.4 - 1.6	1.4 - 1.6
Tap density	g/cm ³	0.5 - 0.65	0.9 - 1.2	0.9 - 1.2
Characteristics		Raw GCA™ material, high capacity, offers design flexibility for manufacturer	GCA™ mixed with graphite to break energy limits for current high-energy cells	High first cycle efficiency but capacity limit has been reached

† Example of how GCA™ can be blended with graphite depending on capacity balance and cell design

G³'s GCA™ development has the support of NSF SBIR Phase I and Phase II programs, (2010 (Phase I) contract number 0944784, 2012).

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BENEFITS

- High storage capacity means longer time between charges
- Higher capacity results in thinner electrodes and thus smaller battery form factors
- Cost comparable to graphite in \$/Ah
- Drop-in solution with current manufacturing processes

WHY G³'S HIGH ENERGY

STRONG IP

G³ filed the world's first patent on a graphene enabled anode (U.S. 7,745,047; 2007) to enhance battery performance. As of today, we hold a more than 44 related patents and patent applications within our portfolio.

SELF-SUSTAINING

As the largest graphene manufacturer in the world, G³ offers the most cost-effective raw materials for our anode products.

KNOW-HOW

G³ has mastered the very essence of silicon anode technology. We produce nano-silicon in-house and specialize in methods of creating a stable anode structure.

AVAILABILITY

Unlike other startups only capable of providing samples in gram quantities, G³ has already achieved material production in the metric tons.

KNOWLEDGEABLE R&D TEAM

With a technical team of more than 20 scientists (most holding Ph. D's), G³ has the skill set and responsiveness to assist customers with not only anode technology, but also electrolyte selection, cathode pairing, and advice for cell assembly, which accelerate the investigation cycle of high-energy battery development.

CONTACT US

Want to learn more? Contact G³ at sales@g3-am.com or call 937-331- 9884.

