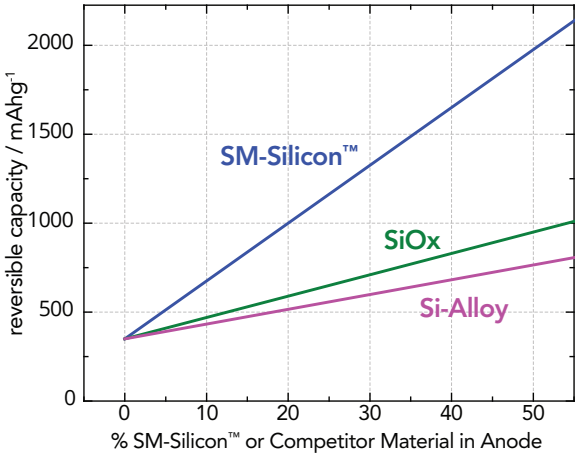
PARACLETE ENERGY

Testing Silicon Oxide? Test Metal-based SM-Silicon™ Too!

Why use *low capacity* **silicon oxide** when you can finally use ***high capacity*, safe SM-Silicon™ metal**?

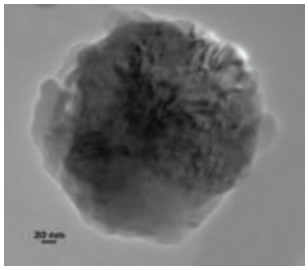
- Paraclete manufacturers nanoparticle **S**urface **M**odified (SM) silicon metal (SM-Silicon™) that has 2.3x the energy density of silicon oxide and 10x of graphite.
- Paraclete's SM-Silicon™ is stable in air and water and can be priced less than graphite $/kWh.
- Paraclete can covalently bond nearly any organic or inorganic material or a combination of both to the silicon's surface. This becomes the SM.
- This SM acts as an artificial SEI.
- Paraclete today manufactures quantities from grams to tons and pricing drops substantially with quantity.
- Paraclete has standard SM products or a SM can be customized for optimization for a customer's application, binder, electrolyte and cathode systems.



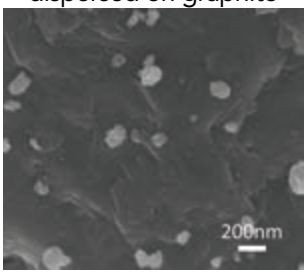
Paraclete Energy's Products

Available in 100g bottles, 5 gallon buckets (10 kg) or 55 gallon drums (100 kg)	
SM-Silicon™	Nanoparticle silicon metal with a proprietary **S**urface **M**odifier that acts as artificial SEI for cycle stability.
SM-Silicon/C™	Nanoparticle silicon metal with a custom **S**urface **M**odifier optimized to the customer's application, binder, electrolyte, and cathode system.
SM-Silicon/PL™	Prelithiated nanoparticle silicon metal with a proprietary **S**urface **M**odifier that acts as a protective shell against air and moisture and as an artificial SEI for cycle stability.
nSiO	Silicon metal with oxide on the surface.
nSi	Raw silicon metal with substantially <0.5% impurities metals basis. This product is highly reactive to air.
nSi/C	Nanoparticle silicon metal with carbon on the surface.
nSi/Cg	Nanoparticle silicon metal with graphene on the surface.
nSi/Cg/P	Nanoparticle silicon metal with graphene and polymer on the surface.

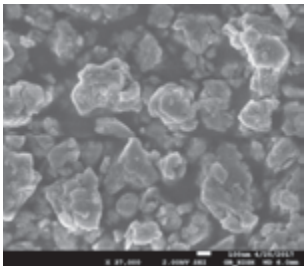
TEM showing SM layer



150 nm SM-Silicon™ dispersed on graphite



SM-Silicon™ 500 nm particles



Why use *low capacity* **silicon oxide** when you can finally use ***high capacity*, safe SM-Silicon™ metal**?

How SM-Silicon™ Enables Stable Cycling of Silicon

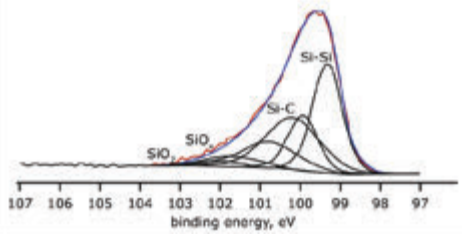
- Paraclete *covalently bonds* nanoparticle silicon with a standard or a proprietary or an optimized customer specific **S**urface **M**odifier (SM).
- **SM-Silicon™** is dioxide free.
- Silicon nanoparticles D50 APS 150 nm *(other APS and surface modifiers can be produced per the customer's preferences for advanced optimization).*
- Paraclete's covalently bonded **S**urface **M**odifier acts as an artificial SEI that mitigates electrolyte reactivity.
- SM can be customized for optimization for a customer's application, binder, electrolyte and cathode systems.

SM-Silicon™ Physical Properties

Form	Crystalline Powder
Purity	≥99.5%
Metals Impurities	<0.5%
APS	150nm (custom sizes available)
BET/SSA	30 m^2/g
Tap density	0.8 g / cm^3 nearly as graphite (1.1 g/cm^3), helps to get denser anode
Morphology	Non-spherical
SM type	Hybrid SEI layer that decreases electrolyte reactions
Coulombic Efficiency	Approaching Graphite

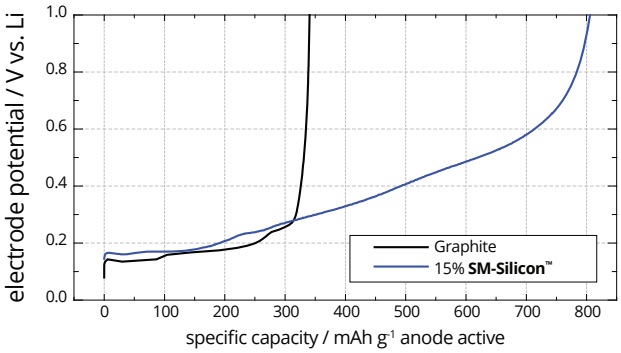
XPS Analysis Shows Covalently Bonded Surface Modifier with No Surface Oxides

With Paraclete's **S**urface **M**odifiers, the contribution from surface oxide bonding is almost completely absent and there is no observed SiO_2.



SM-Silicon™ Delivers Capacity

- Paraclete's **S**urface **M**odifier has substantially no negative impact on the measured capacity vs. theoretical capacity.
- The thickness of SM is 3-5 nm and can be customized to the customer's specification.
- **SM-Silicon™** is air and water stable.



Let Paraclete Energy Optimize High Capacity Silicon Metal Nanoparticles for You Today!

PARACLETE ENERGY

Silicon Nanoparticles & Nanosilicon Composite Powders

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