

July 15, 2020
NGK INSULATORS, LTD.

NGK develops high heat resistance lithium-ion battery achieving an operating temperature of up to 105°C

Nagoya, Japan, July 15, 2020 – NGK INSULATORS, LTD. (hereinafter "NGK") has successfully raised the maximum operating temperature of its coin-type "EnerCera Coin" (part of the "EnerCera®" series) battery up to 105 degrees Celsius. Sample shipments are currently underway, with mass production scheduled to begin in September 2020. The battery's potential applications primarily include automotive and industrial IoT devices.

In December 2019, NGK developed the world's first lithium-ion rechargeable battery which has achieved an operating temperature range of -40 to +85 degrees Celsius. As a result of improvements to the product based on customer feedback, NGK recently succeeded in increasing the upper limit of the operating temperature by 20 degrees. The battery is now capable to be used at an operating temperature of up to 105 degrees Celsius, while still maintaining capacity and power. In its fully charged state, when the battery is most prone to deterioration, capacity decrease is less than 20% even after it is kept at 105 degrees for 1000 hours.

NGK's EnerCera Coin battery has a unique structure in which a small amount of electrolyte is added to its all ceramic stacked monolithic body with electrodes and a separator. This provides high thermal stability. The EnerCera battery is categorized as semi-solid-state battery, with performance equivalent to or better than that of a conventional lithium-ion rechargeable battery. The EnerCera battery's excellent heat resistance characteristics are comparable to those of all-solid-state batteries.

In addition, EnerCera Coin offers flexibility in installation. It can be mounted on a circuit board by reflow soldering, which is a common method for mounting electronic components on a board. Furthermore, the battery can also be mounted through injection molding, where molten resin with temperatures of up to 300 degrees is poured into the mold and the battery directly embedded into the resin structure. This allows for the realization of an electronic device with unprecedented design and robustness.

With regards to the latest technological improvements, Iwao Ohwada, Vice President at NGK commented that the "development of high heat resistance products was realized through feedback from various partners in the automotive, industrial, logistics and smart card industries. We will continue to work closely with our partners to develop innovative solutions that accelerate the spread of IoT solutions."

About EnerCera Battery Series

The EnerCera battery series is a compact, thin, high energy density lithium-ion rechargeable battery that uses NGK's original crystal-oriented ceramic plate for electrodes. Since it has high heat resistance characteristics, it can be mounted on a device at high temperature. There are two types: the coin-shaped EnerCera Coin and the thin EnerCera Pouch that can be mounted on an IC card through hot lamination. The EnerCera battery series was awarded with the CES Innovation Awards in 2019 in the Smart Energy category. NGK will continue to provide updates on the latest developments of the EnerCera battery series through its newsroom and at international events. Follow us on our [newsroom](#).

About NGK INSULATORS, LTD.

NGK is the world's largest manufacturer of electrical insulators and has developed numerous products in the electronics and automotive sectors with top shares globally. The company celebrated its 100th anniversary in 2019. NGK is also the world's leading manufacturer succeeding in the commercialization of large-capacity energy storage systems (NAS batteries), which has overturned the conventional wisdom that power cannot be stored. These have been installed in over 200 different locations worldwide. To learn more about NGK, visit: <https://www.ngk-insulators.com/en/index.html>

EnerCera Battery Series



EnerCera Coin



EnerCera Pouch

EnerCera Coin Specifications (high heat resistance type)

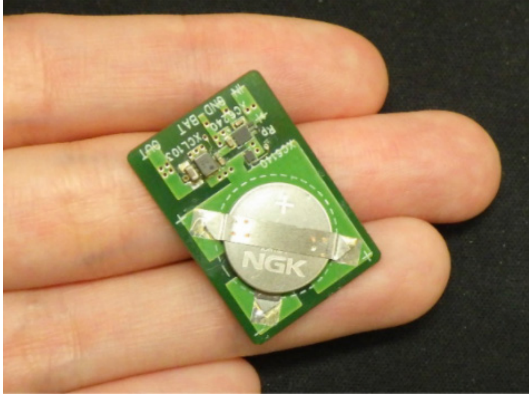
品番	ET1210C-H	ET2016C-H
Dimensions (mm)	Φ12×1.0t	Φ20×1.6t
Nominal Capacity (mAh)	4	20
Nominal Voltage (V)	2.3	2.3
Energy Density (mWh/cc)	80	90
Constant Voltage (CV) Charging	OK	OK
Peak Discharge Current*(mA)	20	45
Operating Temperature (recommended)	-40°C to 105°C	
Mounting Method	Reflow soldering (compatible with surface mounting)	

* Maximum current within 0.5 V drop for 1 sec (25°C)

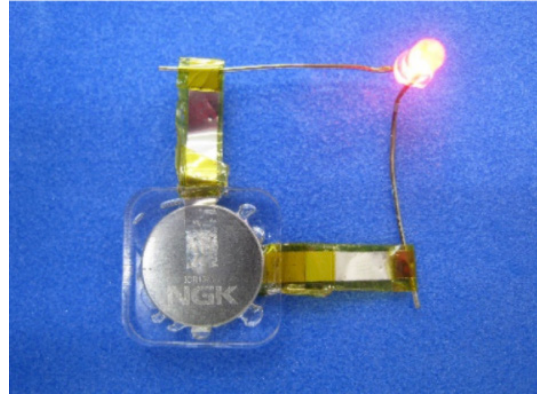
Comparison of small-sized power storage devices

		Liquid Li-ion battery (Coin type)	Semi-solid-state battery	Solid-state battery
Battery Structure	Electrolyte	Organic liquid electrolyte	Organic liquid electrolyte	Solid electrolyte
	Electrode	Powder coating of active material	Active material ceramics	Active material + solid electrolyte Mixed ceramics
Performance	Energy density	Good	Very good	Poor
	Power (High-current discharge)	Poor	Good	Very poor
Durability	Heat resistance	Very poor (up to 60°C)	Good (105°C)	Good (up to 105°C)
	Installation by solder reflow	No good	Good	Good

EnerCera Coin with high heat resistance



Reflow soldered to power IC circuit
EnerCera Coin High heat resistance type



EnerCera Coin high heat resistance type
embedded in resin by injection molding

* The information disclosed in this press release is current as of the time of release.

NGK contributes to the achievement of the SDGs.

Ceramics for electric and electronic machinery support affordable and universal information and communications technology.

