CRYSTALLINE ENERGY RESEARCH

Innovative Research Discovery

New Dielectric Crystals Will Store More Energy Than Batteries

CER was founded to explore and research new and better ways to store electric energy in crystals, which would offer improved performance over electrochemical Lithium-based batteries.

CER has discovered the beginnings of a new paradigm shifting energy storage technology. The discovery is a non-electrochemical, non-battery alternative pathway to achieving revolutionary energy densities far above those of Li-Ion batteries.

The technology consists of novel ceramic dielectric crystalline materials exhibiting exponential quantum leaps in dielectric constants (K values) to 400-500 million. This discovery has the potential to greatly exceed the energy densities of Li-Ion batteries, since capacitive energy is based on the direct relationship of K values to capacitance and high voltage charging to energy storage. When market ready, this technology could be manufactured into a configuration similar to a Tesla 18650 battery cell format. With this or any other format fast charging could be accomplished by the 480VDC Tesla Supercharger System, yielding a theoretical energy density of 2,900 Wh/Kg. This energy density could theoretically provide an EV 700 miles of range from one charge of an 80 Kg energy pack.

CER's prototype dielectric crystalline materials were formed, without electrolytes, into ceramic capacitor disc pellets with conductive film layers by multi-stage ceramic processing for capacitance testing to measure K values.

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Temperature testing of our prototypes has revealed that the high K values are maintained over a temperature of -70°C to +250°C, with no fires, leakage, or decomposition occurring.

CER's prototype results theoretically suggest that complex, dielectric, unsymmetrical quasicrystals are being created. The higher K values also imply that greater relative dipole displacements are occurring than have been observed in Barium Titanate ($BaTiO_3$) modified dielectrics.

CER's prototypes have been demonstrated to the Materials Science Department Head at Boise State University who concluded that CER may have synthesized a new class of materials with potential for energy storage.

Our continuing research and development is dedicated to the goal of enhancing and optimizing the overall electrical properties by determining the optimum ion species and their lattice positions to additionally improve the energy storage characteristics of the discovery. CER's discovery opens the door to new capacitive energy storage research frontiers with many new applications in energy and power storage.

The following chart compares theoretical predicted metrics between our technology and existing Lithium-Ion battery properties.

CER's Innovation Theoretical/Predicted Values
vs.
Commercial Lithium-Ion Battery Properties

Characteristics	CER's Innovation	Li-Ion Batteries
Chemistry Basis	Ceramic Dielectric Crystals	Electro-Chemical
Chemical Reactions	No	Yes
Use of Electrolytes	No[1]	Yes
Dielectric Constant	400 to 500 Million+[2]	N/A
Operating Temperature Range	-70°C to +230°C[2]	-30°C to +70° C
Energy Density (Wh/Kg)	800 to 3,000+	250 to 350
Power Density (W/Kg)	100,000+	1,000 to 3,000
Charge Time	30 to 180 seconds	10 to 60 minutes
Cycle Life	5 Million+	500
Charging Voltage (VDC)	50 to 20 K	2.4 to 4.2
Service Life (Years)	80+	5 to 10
Cost KwH/Kg	$25 to $75	$250 to $500

Notes: [1] **By design**

[2] **Tested results**

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