LICAP
Lithium Ion Capacitors

Introduction

Lithium Ion Capacitors (LIC) are long life, maintenance free energy storage devices that can be used in a variety of systems and applications.

LIC's are ideal in situations where battery maintenance and replacement are inconvenient, costly or impossible. High current charge / discharge capability, low self-discharge rate, wide operating temperature range and a high degree of safety are a few of the beneficial characteristics of the LIC. With a 10+ year calendar life and cycle life in the hundreds of thousands, an LIC can be designed in to last the entire life of a system.

Example applications: Back-up power • Remote monitoring systems • Energy harvesting devices • Auxiliary power systems Voltage sag support • Graceful power down • Automotive & Electric vehicle systems • Energy recuperation systems • Autonomous power supply systems • Renewable energy systems

About us

LICAP Technologies, Inc. is a leader in the development of sustainable manufacturing solutions for electrodes used in ultracapacitors, lithium-ion capacitors, lithium-ion batteries, and, most recently, in solid-state batteries. The core technology, **Activated Dry Electrode™** process, is applicable to manufacturing of low-cost premium electrodes for a variety of secondary energy storage applications.

LICAP's patented **Activated Dry Electrode™** technology enables the industry leading ESR, capacitance, high power density, long calendar life and cycle life characteristics of our Ultracapacitor and Lithium-ion Capacitor cells and modules. LICAP's Ultracapacitor cells and modules offer reliable solutions in a variety of commercial applications requiring high-power density.

Co-founded and led by the original inventor of the "dry electrode" technology, LICAP is headquartered in Sacramento, California and employs more than 150 people worldwide.

COMPARED TO Li-ION BATTERIES:

- **Higher Power Density**
- **3-5X Calendar Life**
- **Up to 100X Cycle Life**
- **No Thermal Runaway**

LICAP is the ONLY Manufacturer of *TABLESS* Cylindrical LIC's

Form Factor Compatible with Lithium-Ion Batteries

200F	800F
↕	↕
18650 Cell Size	32650 Cell Size

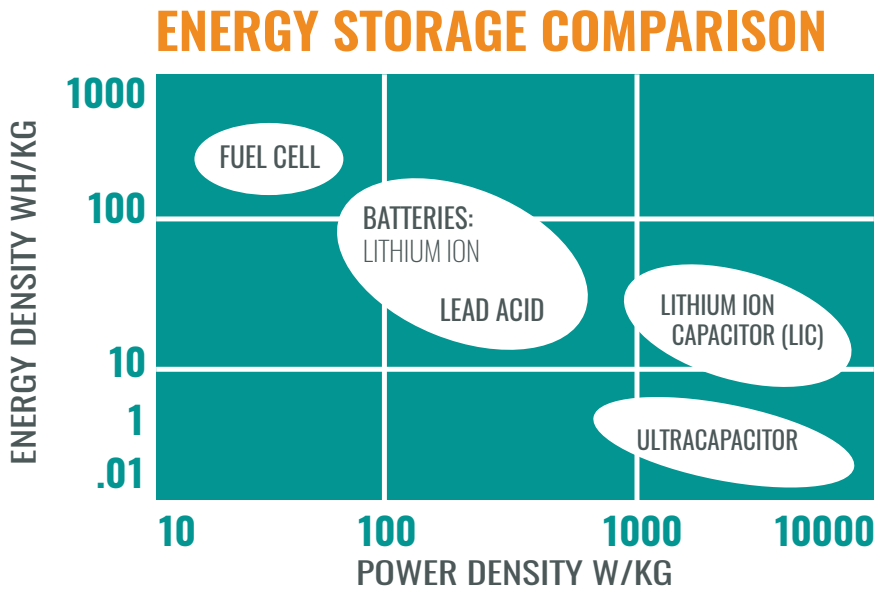
LICAP

Lithium Ion Capacitors

The Technology:

A lithium-ion capacitor (LIC) is a combination of ultracapacitor and lithium-ion battery technologies.

The LIC cathode consists of activated carbon, and the anode is a carbon material formulation which is pre-doped lithium metal. The pre-lithiation process reduces the potential of the anode and enables a higher output voltage as compared to a traditional ultracapacitor. The resulting hybrid (energy storage) device has doubled energy density compared with an ultracapacitor and increased power density and cycle life compared with a Li-ion battery along with a low self-discharge rate.



The table below compares major characteristics of double-layer capacitors, LIC and lithium ion batteries.

Compared to a double-layer capacitor, the LIC has similar life and power performance with the added benefits of higher energy density, low self-discharge and higher cell voltage. Compared to a lithium ion battery, the LIC has longer life, higher power density, wider operating temperature range and is considered a safer technology.

Characteristics	EDLC	LIC	LIB
Nominal Cell Voltage	2.7V – 3.0V	3.8V	3.2V - 3.7V
Maximum Power Density[1] (W/Kg)	8,000 - 15,000	2,000 - 2,400	100 - 700
Energy Density (Wh/Kg)	5.5 - 7.15	10 - 14	100 - 275
Calendar Life	10 - 15+ Years	10+ Years	2 - 4 Years
Cycle Life	1 Million	100K	1000 - 3000
Self-Discharge	30% over 1 Month	< 5% over 3 Months	.35% - 2.5% per Month
Thermal Runaway	No	No	Yes
Shipping Regulations	Moderate	Moderate	Strict
Temperature Range	-45C to +65C	-20C to +70C	-20C to +60C

Samples available, please contact us for additional information.

(1) Max Power Density = 0.25 x V^2 / ESR x Weight

LICAP Technologies, Inc.

9795 Business Park Drive - Sacramento, CA 95827 USA
https://LICAPtech.com/ • info@LICAPtech.com