Litigation Webinar Series

Strategic IP Considerations of Batteries and Energy Storage Solutions

February 10, 2022

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Meet The Speakers

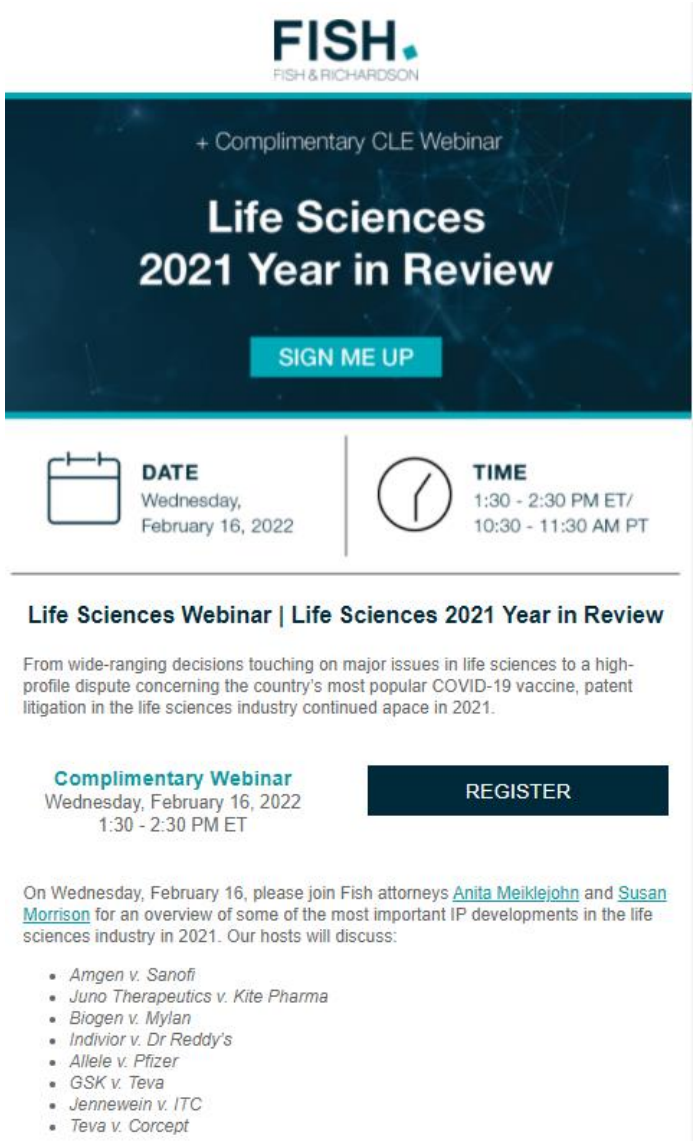
Hyun Jin (HJ) In
Principal

Daniel A. Tishman
Principal

Ralph A. Phillips
Principal

Overview

- **Housekeeping**
  - CLE
  - Questions
  - Materials
    - http://www.fr.com/webinars

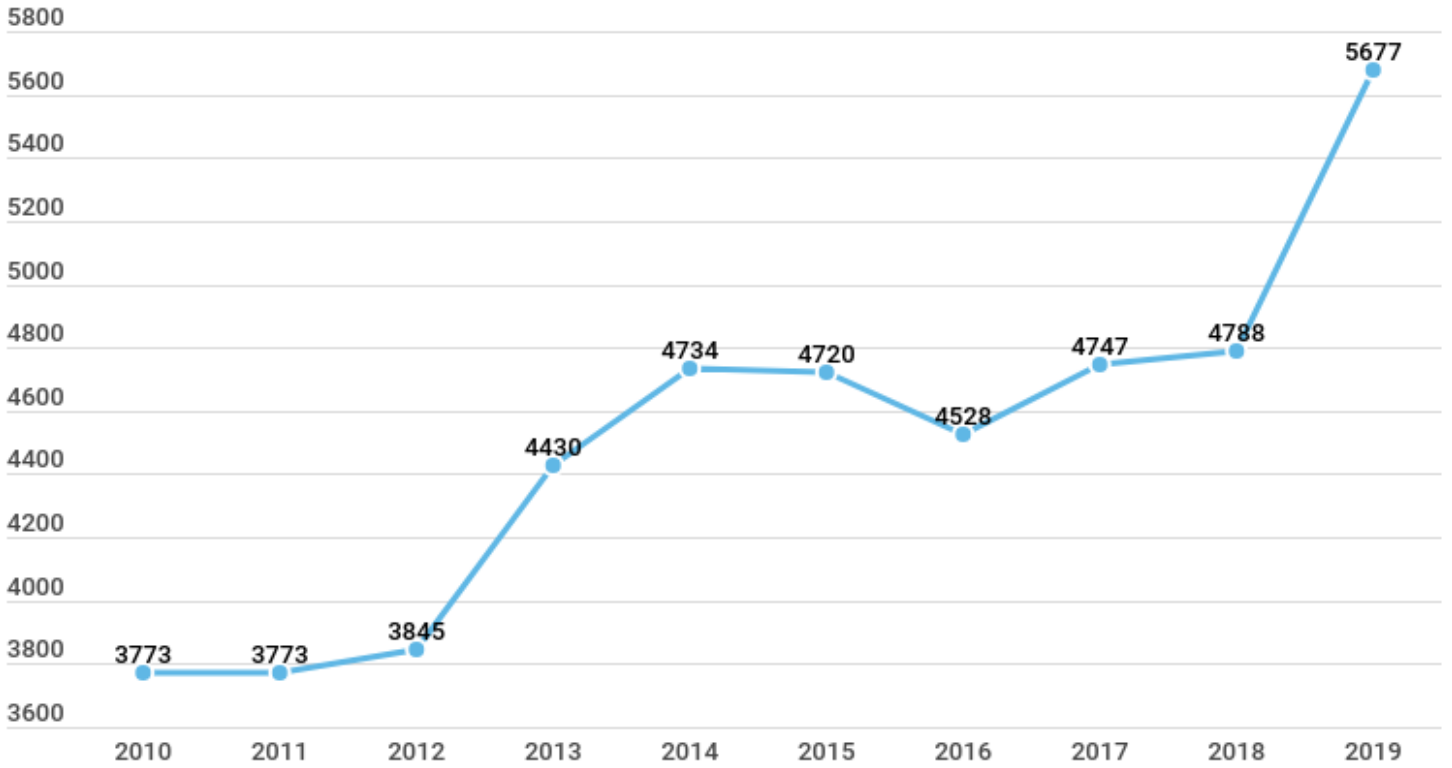


Agenda

- Battery Industry Growth and Trends
- Battery Technology Overview
- Policy Considerations
- Patent Prosecution, Portfolio, and Strategic Patenting
- IP Enforcement and Litigation

Battery Industry Growth and Trends

Battery Patent Filings: CPC Class H01M



H01M: PROCESSES OR MEANS, e.g. BATTERIES, FOR THE DIRECT CONVERSION OF CHEMICAL ENERGY INTO ELECTRICAL ENERGY

Source: Juristat as of 8/17/21

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The Battery Development Race

The battery development race has the potential to transform not only the automotive industry but also the way we live.

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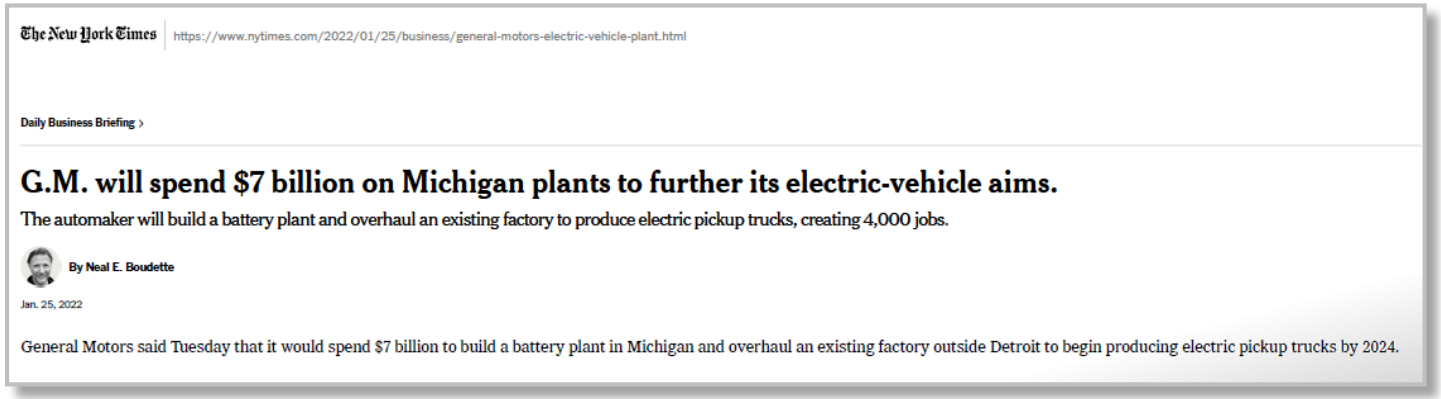
The Battery Development Race

The expansion of battery-related technology is also fueling significant growth in manufacturing investments and jobs in the United States and abroad.



The New York Times | https://www.nytimes.com/2022/01/25/business/general-motors-electric-vehicle-plant.html

Daily Business Briefing ›

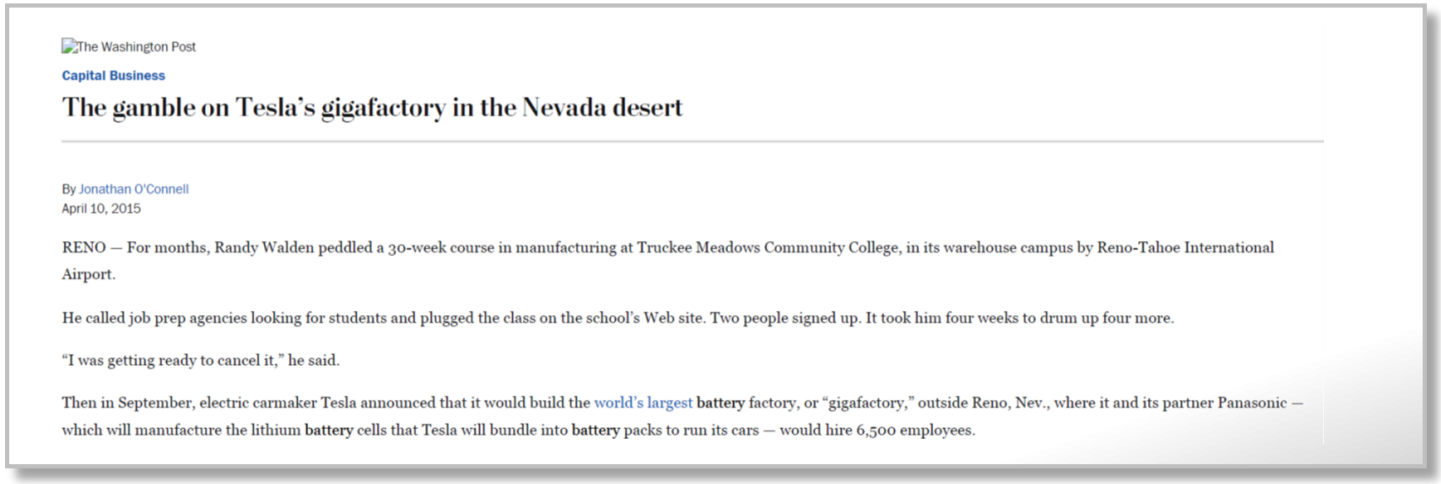
G.M. will spend $7 billion on Michigan plants to further its electric-vehicle aims.

The automaker will build a battery plant and overhaul an existing factory to produce electric pickup trucks, creating 4,000 jobs.

By Neal E. Boudette

Jan. 25, 2022

General Motors said Tuesday that it would spend $7 billion to build a battery plant in Michigan and overhaul an existing factory outside Detroit to begin producing electric pickup trucks by 2024.



The Washington Post

Capital Business

The gamble on Tesla's gigafactory in the Nevada desert

By Jonathan O'Connell
April 10, 2015

RENO — For months, Randy Walden peddled a 30-week course in manufacturing at Truckee Meadows Community College, in its warehouse campus by Reno-Tahoe International Airport.

He called job prep agencies looking for students and plugged the class on the school's Web site. Two people signed up. It took him four weeks to drum up four more.

"I was getting ready to cancel it," he said.

Then in September, electric carmaker Tesla announced that it would build the world's largest **battery** factory, or "gigafactory," outside Reno, Nev., where it and its partner Panasonic — which will manufacture the lithium **battery** cells that Tesla will bundle into **battery** packs to run its cars — would hire 6,500 employees.

USA TODAY

CARS

Ford to build new plants in Tennessee, Kentucky in $11 billion investment in electric vehicles

Phoebe Wall Howard
Detroit Free Press

Published 8:23 a.m. ET Sept. 28, 2021

Ford Motor Co. on Monday announced plans to invest $11 billion to build several new plants to produce parts for electric vehicles, creating nearly 11,000 jobs.

This company will pay for a new assembly plant to build all-electric F-Series trucks and three battery plants, including factories in Kentucky and Tennessee.

https://www.washingtonpost.com/business/capitalbusiness/the-gamble-on-teslas-gigafactory-is-a-big-one--in-many-fashions/2015/04/10/50e9de40-d4c8-11e4-a62f-ee745911a4ff_story.html

https://www.nytimes.com/2022/01/25/business/general-motors-electric-vehicle-plant.html

https://www.usatoday.com/story/money/cars/2021/09/28/ford-motor-company-electric-vehicle-plants-batteries-kentucky-tennessee/5896095001/

The Battery Development Race

In the coming years, while lithium-ion battery technology will continue to grow along with the market for EVs, consumer products, and home energy storage solutions, new technologies, including "solid-state batteries," are making waves.

Autoweek Subscribe Sign In

Mercedes and ProLogium Team Up on Solid-State Tech

The race for solid-state batteries is on, as automakers place bets on multiple developers for longer range, lighter weight and reduced energy-intensive mining.

BY JAY RAMEY FEB 7, 2022

USA TODAY

POLITICS

'No turning back:' Biden signs order targeting half of all vehicles sold in US to be zero-emissions by 2030

Joey Garrison and Courtney Subramanian USA TODAY
Published 5:00 a.m. ET Aug. 5, 2021 | Updated 7:30 a.m. ET Aug. 6, 2021

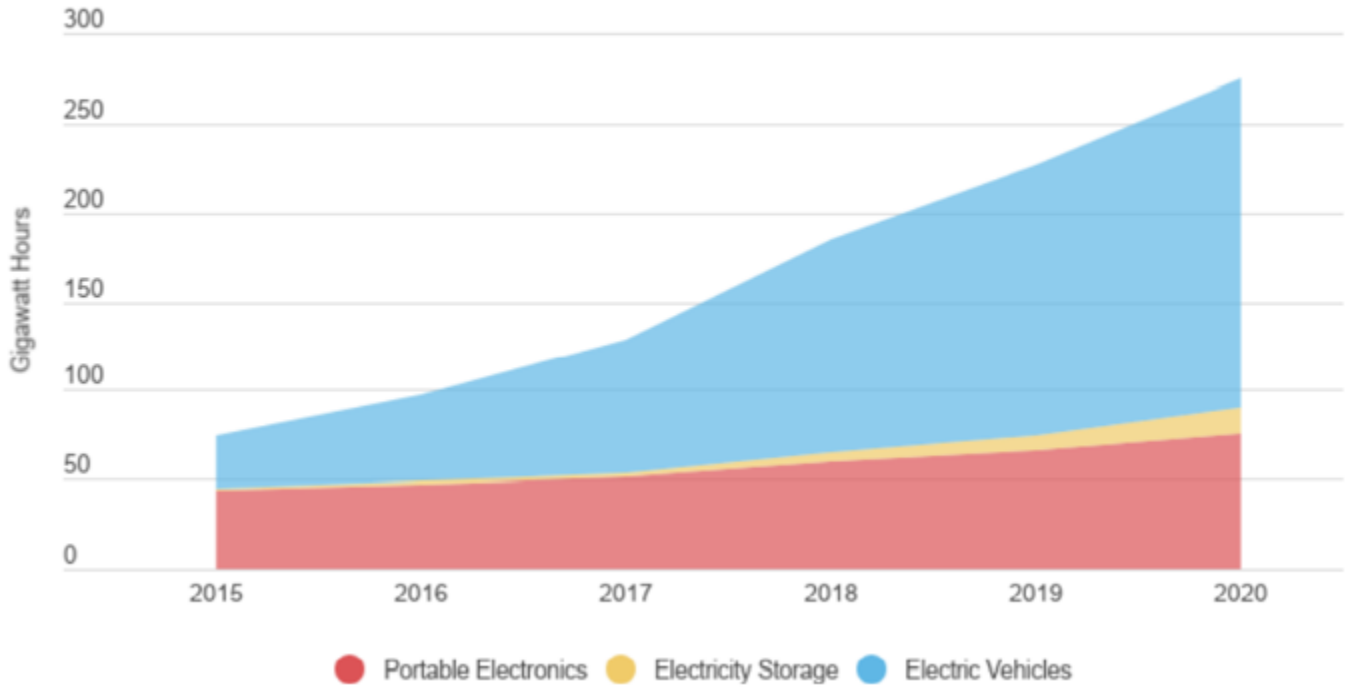
WASHINGTON – President Joe Biden said "there's no turning back" on the future of an electric auto industry Thursday as he signed an executive order setting a target for zero-emissions vehicles to account for half of all automobiles sold in the USA by 2030.

https://www.usatoday.com/story/news/politics/2021/08/05/president-joe-bide-zero-emissions-vehicles-2030-goal/5489643001/
https://www.autoweek.com/news/technology/a39001430/mercedes-benz-prologium-solid-state-battery/

Battery Technology Overview

Global Production of Lithium-Ion Cells by Usage

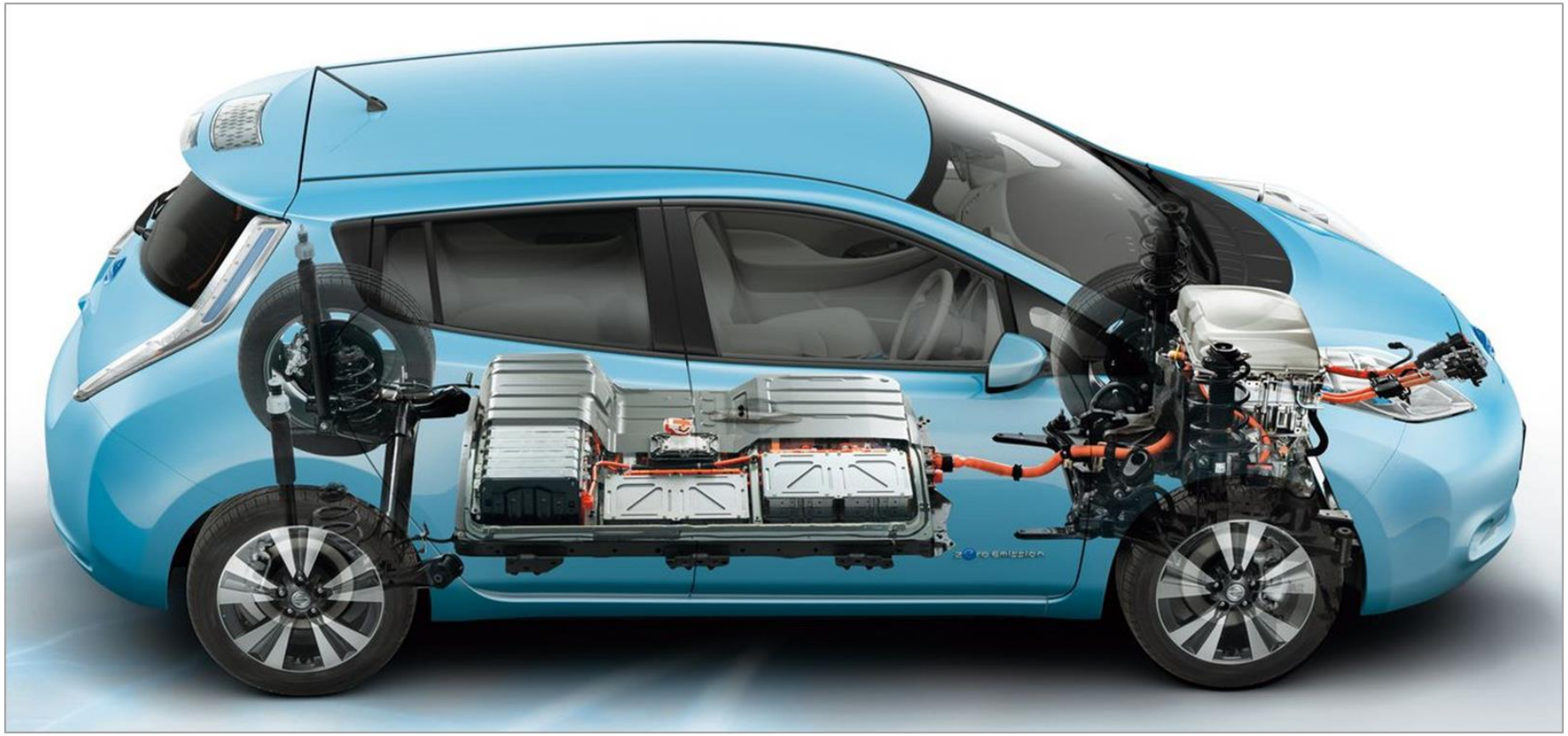
Figure 2: Global Production of Lithium-Ion Cells by Usage



https://www.wsj.com/articles/the-battery-is-ready-to-power-the-world-11612551578

Lithium-Ion Batteries in Electric Vehicles

Electric vehicles include large battery “packs.”



Lithium-Ion Batteries in Electric Vehicles

Electric vehicle packs include multiple “modules.” Each “module” includes multiple “cells.”

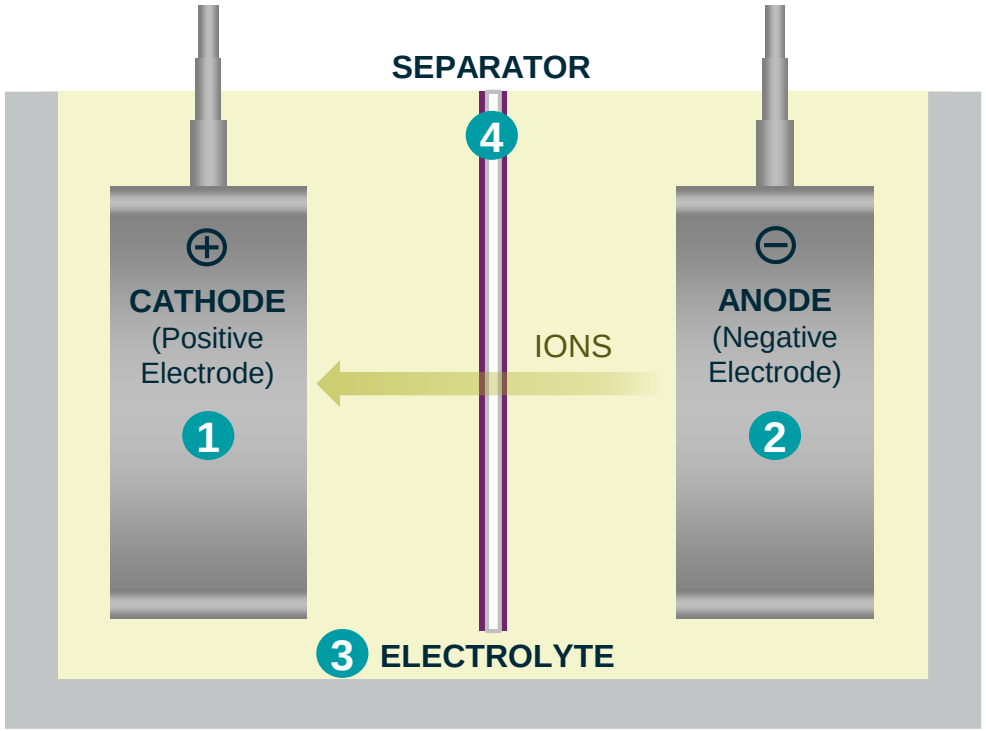
Pack

Module

Cell

Elements of a Li-ion Battery Cell

A battery cell comprises electrodes, a separator, and electrolyte. There are two types of electrodes: a **cathode** (positive electrode) and an **anode** (negative electrode). The **electrolyte** is a liquid that bathes the anode, cathode, and separator and helps facilitate the operation of the battery. The **separator** provides a physical barrier between the anodes and cathodes thereby preventing short circuits.



Batteries consist of at least these four parts:

1	**Cathode** (Positive Electrode)	During discharge, accepts lithium ions from anode
2	**Anode** (Negative Electrode)	During discharge, provides positively charged lithium ions to cathode
3	**Electrolyte**	Liquid, allows lithium ions to flow
4	**Separator**	Physical barrier between anode and cathode, preventing short circuits

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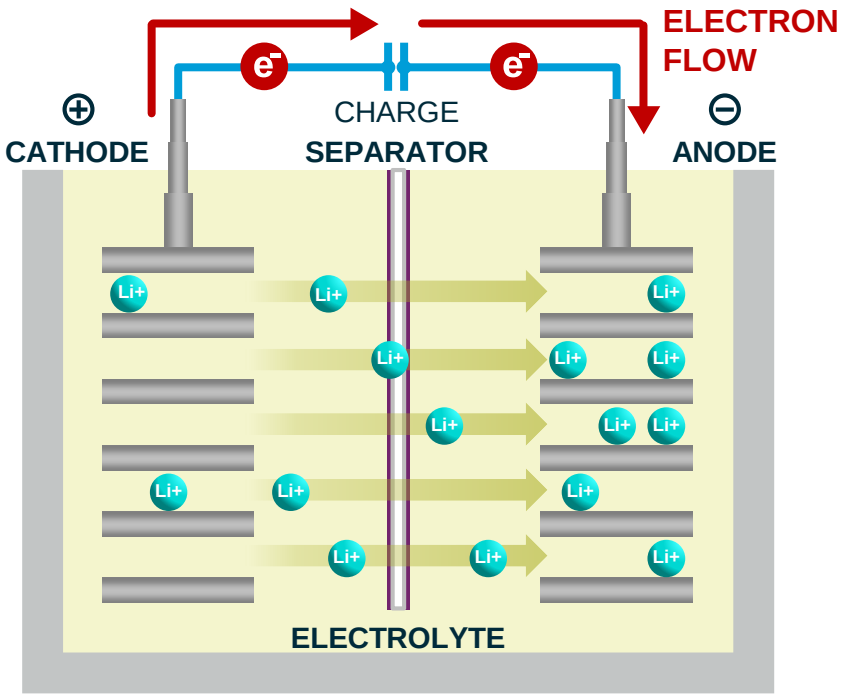
How a Li-ion Battery Works

A battery converts chemical energy to electrical energy through electrochemical reactions that occur at the **anode** and the **cathode**, which are made of different materials. A charged anode gives up electrons, and the cathode accepts them. As long as the circuit connecting the cathode and anode is open, the two chemistries are isolated and stable. When the circuit is closed, negatively charged electrons flow through the circuit from anode to cathode, and positively charged ions also flow through the **electrolyte** and **separator** from anode to cathode. When both ions and electrons flow from anode to cathode, useful current can be used to power a device.

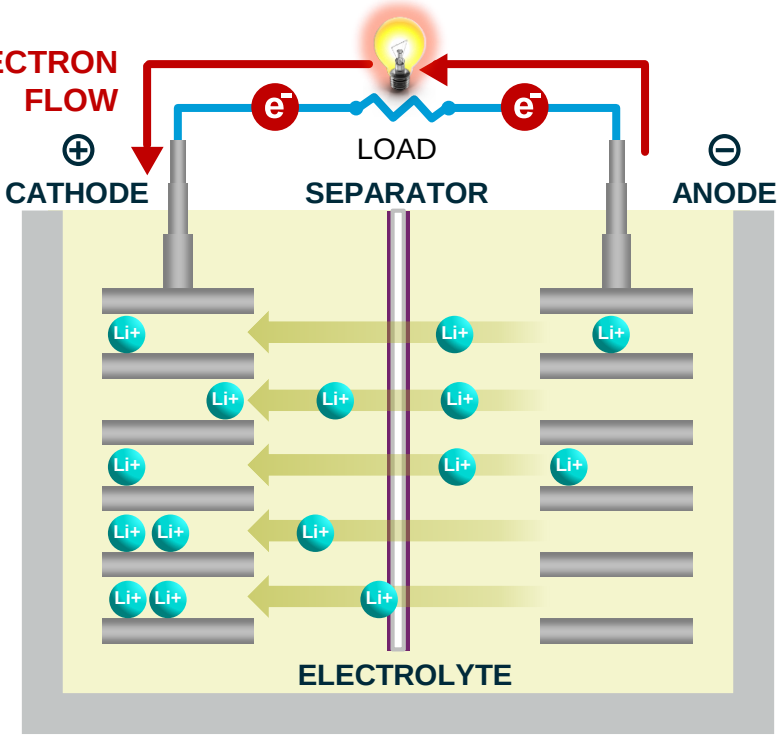
CHARGING

Lithium ions flow from cathode to anode



DISCHARGING

Lithium ions flow from anode to cathode



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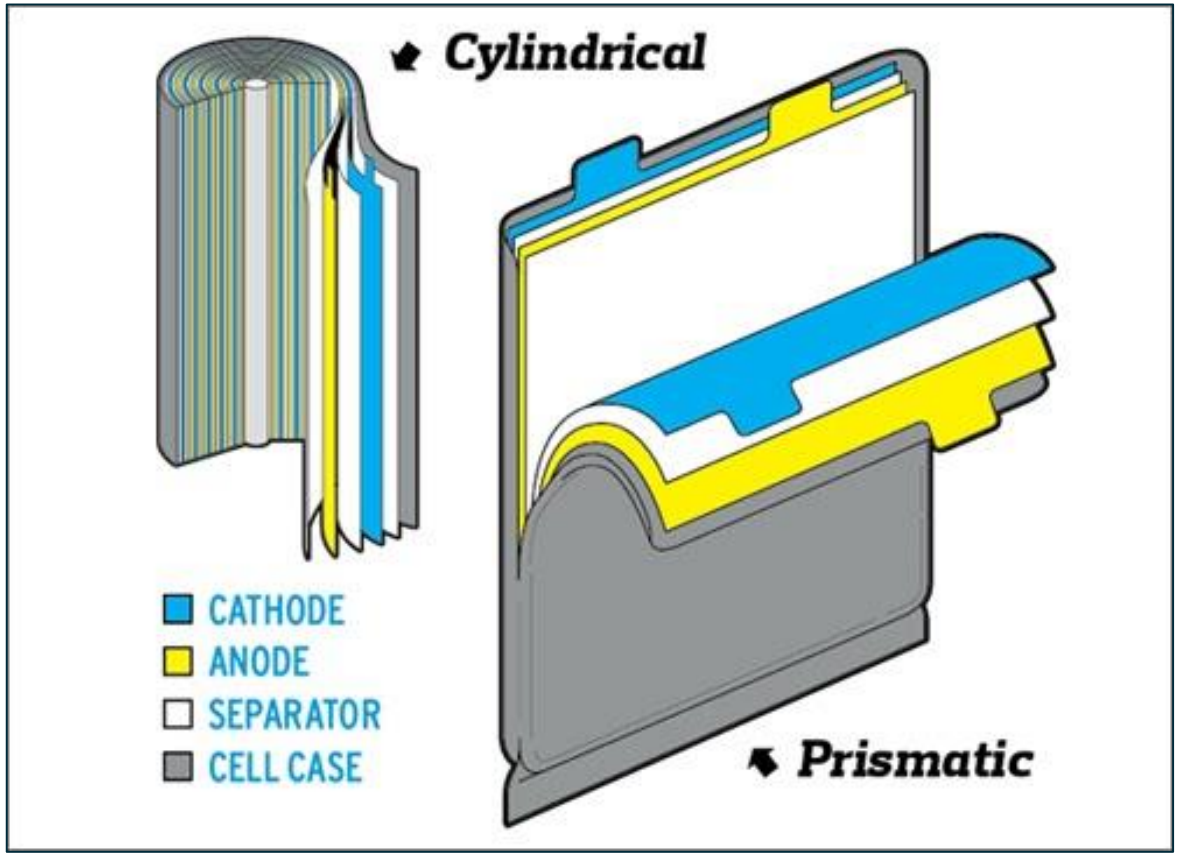
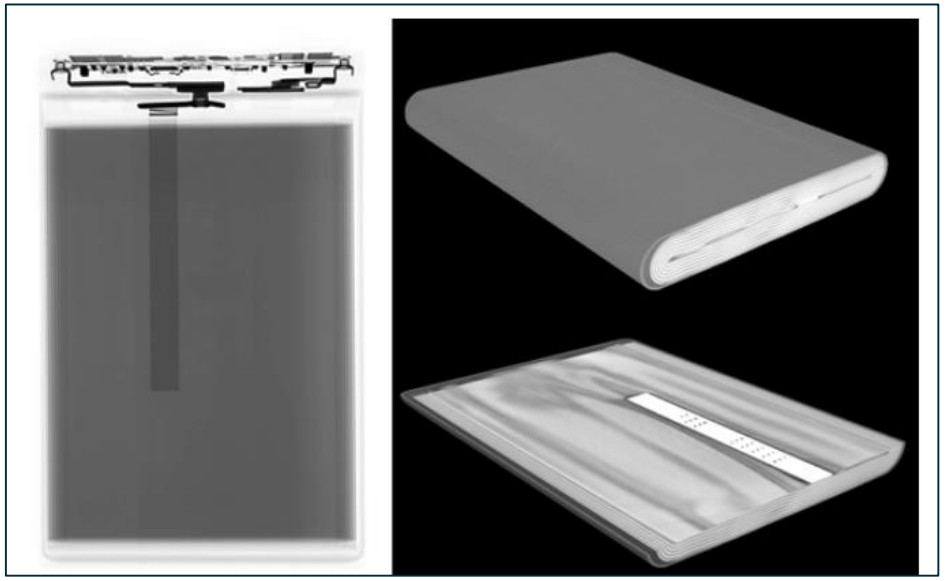
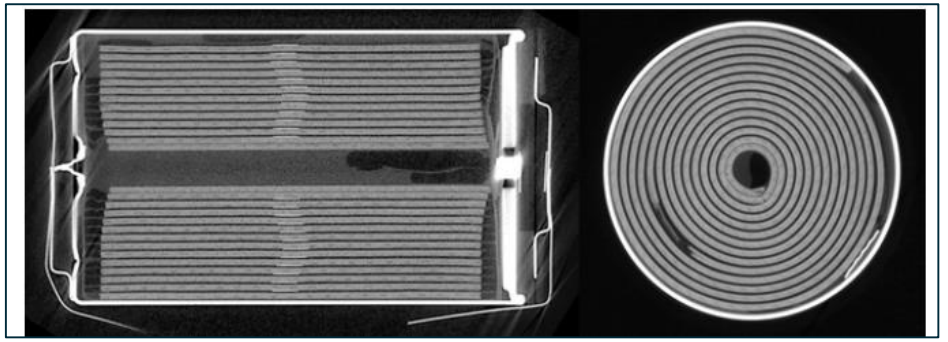






Source: https://m.futurecar.com/1751/Toyota-Expands-Partnership-With-Panasonic-on-Battery-Technology

Source: https://nts.com/ntsblog/x-ray-computed-tomography-ct-scanning-battery-cells/

Solid-State Batteries

While lithium-ion batteries continue to dominate, solid-state batteries are being carefully studied as a potentially safer alternative with higher energy density.

- Solid-state batteries are batteries that use solid electrodes and a solid electrolyte instead of the traditionally liquid or polymer gel electrolytes used in lithium-ion batteries. With a rise in research and development, so too comes a rise in patent filings and activity as competitors race to improve the technology and make it cheaper.
- Patent filings associated with this emerging technology are dominated by many of the same companies that lead in overall battery patent filings, including Toyota, LG, Panasonic, BYD, Samsung, and CATL, among others.

Policy Considerations

Policy Considerations

A number of policies are gaining support within the United States and internationally, encouraging a shift away from fossil fuels propelling the growth of the EV industry (the largest market for batteries).

THE WHITE HOUSE

BRIEFING ROOM

Executive Order on Strengthening American Leadership in Clean Cars and Trucks

AUGUST 05, 2021 • PRESIDENTIAL ACTIONS

By the authority vested in me as President by the Constitution and the laws of the United States of America, and in order to promote the interests of American workers, businesses, consumers, and communities, it is hereby ordered as follows:

Section 1. Policy. America must lead the world on clean and efficient cars and trucks. That means bolstering our domestic market by setting a goal that 50 percent of all new passenger cars and light trucks sold in 2030 be zero-emission vehicles, including battery electric, plug-in hybrid electric, or fuel cell electric vehicles. My Administration will prioritize setting clear

THE WHITE HOUSE

BRIEFING ROOM

FACT SHEET: The Biden-Harris Electric Vehicle Charging Action Plan

DECEMBER 13, 2021 • STATEMENTS AND RELEASES

Vice President Kamala Harris to Announce Action Plan that Fast Tracks Bipartisan Infrastructure Law Investments

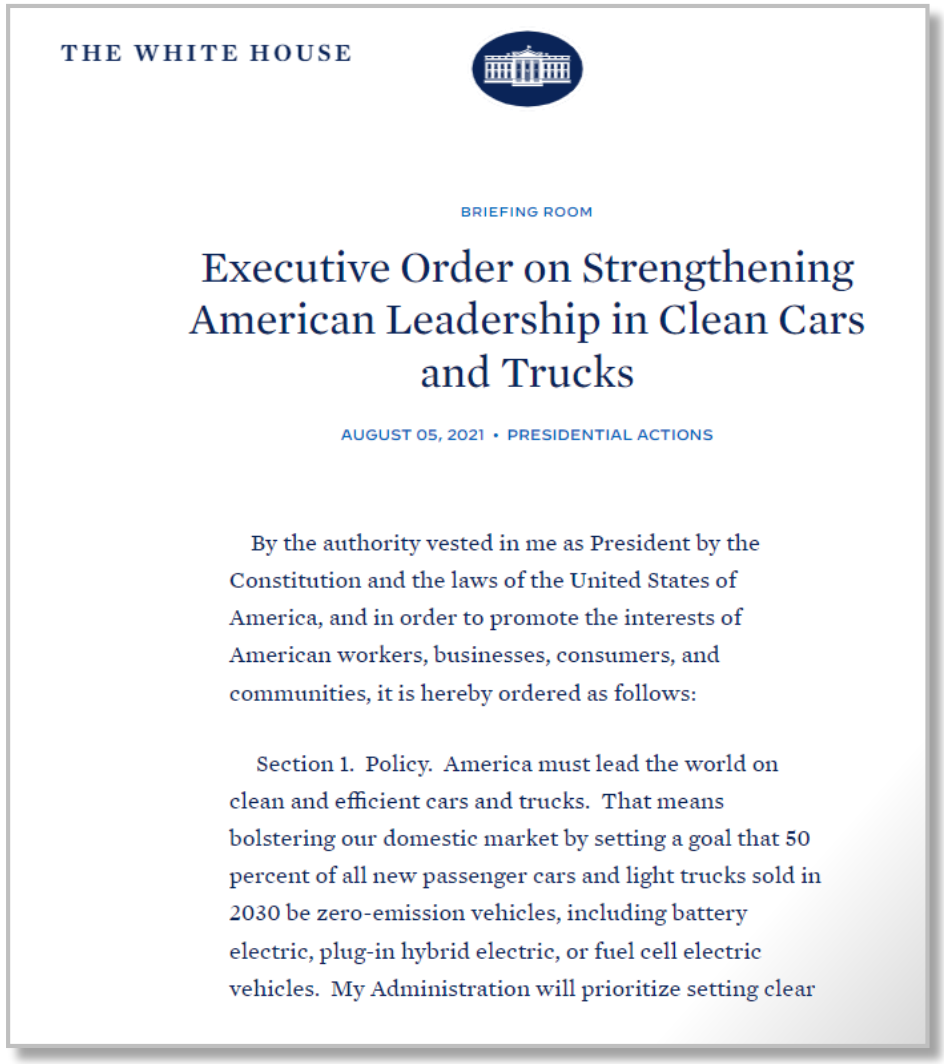
President Biden has united automakers and autoworkers to drive American leadership forward on clean cars, and he set an ambitious target of 50% of electric vehicle (EV) sale shares in the U.S. by 2030. Now, the Bipartisan Infrastructure Law will supercharge America's efforts to lead the electric future, Building a Better America where we can strengthen domestic supply chains, outcompete the world, and make electric cars cheaper for working families.

President Biden, American families, automakers, and autoworkers agree: the future of transportation is electric.

Executive Order 14037

Executive Order 14037: "Strengthening American Leadership in Clean Cars and Trucks"

- Sets a goal of 50% zero-emissions vehicles by 2030
- Directs EPA to consider rulemaking to establish new emissions standards beginning in 2027
- Directs Secretary of Transportation to consider rulemaking to establish new fuel economy standards beginning in 2027



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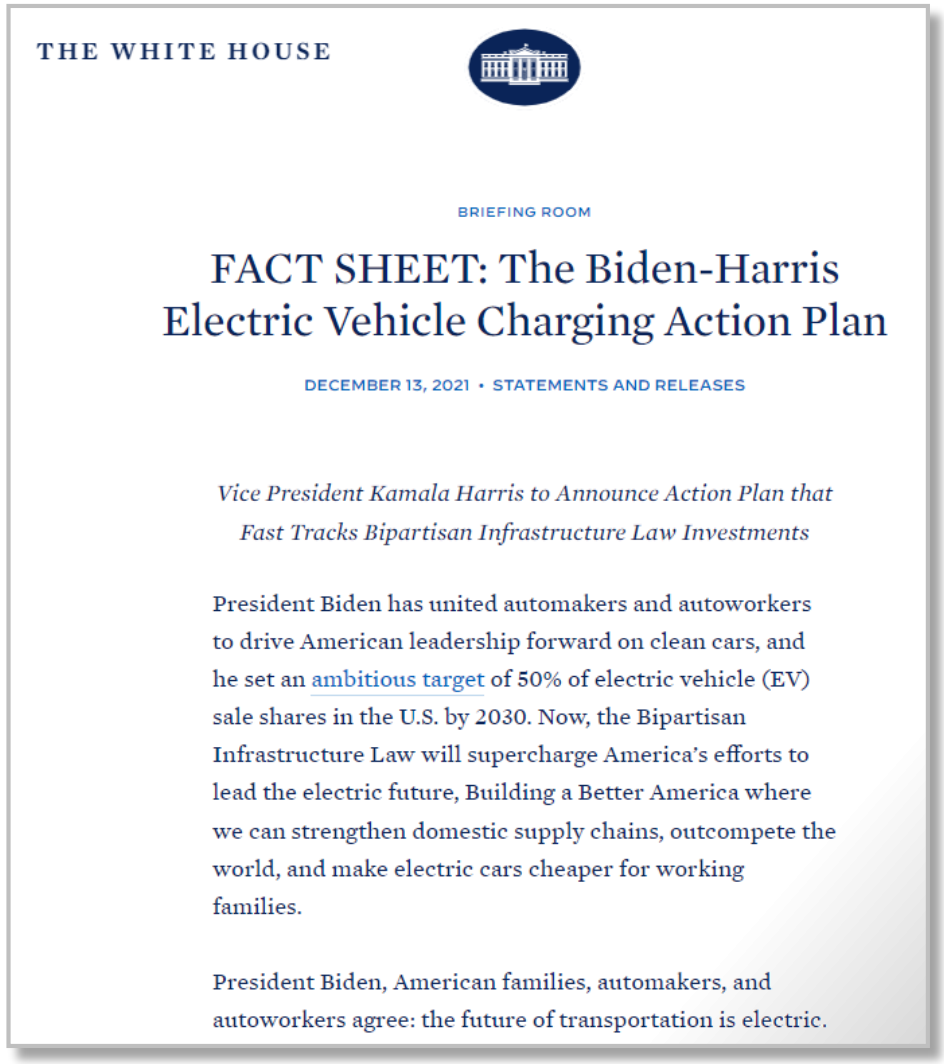
https://www.whitehouse.gov/briefing-room/presidential-actions/2021/08/05/executive-order-on-strengthening-american-leadership-in-clean-cars-and-trucks/

2021 Infrastructure Bill

The 2021 Infrastructure Investment and Jobs Act allocates $7.5 billion to build a network of EV chargers and $6 billion for battery development

Key Provisions:

- $5 billion for states to build charging networks
- $2.5 billion for communities to build charging networks
- $3 billion for battery minerals and refined materials to accelerate development of a North American battery supply chain
- $3 billion for building, retooling, and expanding manufacturing of batteries and components



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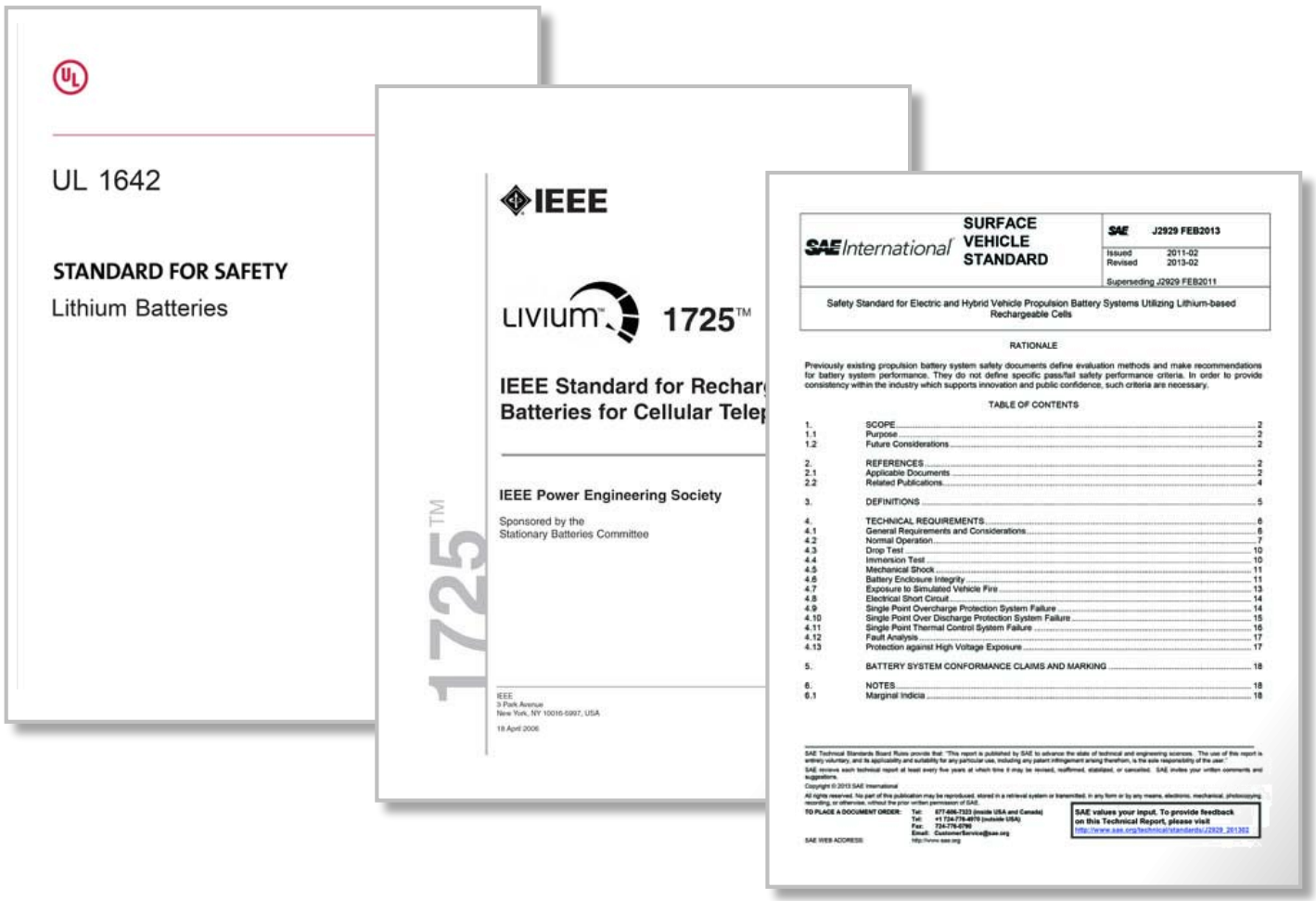
https://www.whitehouse.gov/briefing-room/statements-releases/2021/12/13/fact-sheet-the-biden-harris-electric-vehicle-charging-action-plan/

Standard Setting Organizations

Standard setting organizations in LiB industry develop and promulgate voluntary battery standards as well as certify compliance

- Underwriters Laboratories (UL)
- Institute of Electrical & Electronics Engineers (IEEE)
- American National Standards Institute (ANSI)
- Society of Automotive Engineers (SAE)



Patent Prosecution, Portfolio, and Strategic Patenting

Patent Prosecution, Portfolio, and Strategic Patenting Considerations

A patent is a grant of property from the government of the right to exclude others from making, using, offering to sell, selling, or importing the invention claimed in the patent. Although the power to enforce this right depends on the circumstances, patents offer an important competitive tool.

- Patents have contributed significantly to the advances in science and technology that make lithium-ion batteries more **affordable and efficient today.** There has been a sharp increase in battery patenting activity over the past few years, as noted elsewhere.

- Most of that activity has been focused on improvements to existing technologies, such as **innovations in next-generation materials and components, films and coatings, electrolyte solutions, and fabrication techniques,** among many others. Venues for groundbreaking innovation continue to open up, particularly in the solid-state battery space. For example, Ford and BMW announced in May 2021 that they had invested $130 million in solid-state battery startup Solid Power to deliver batteries that will be deployed in EVs by 2030.

- Competition among **disruptive startups** seeking the next breakthrough, as well as **small-scale improvements** to existing lithium-ion technologies, are **driving battery patenting activity** not only in the **USPTO** but also in the **federal district courts** and the **ITC** – each of which has seen increased battery litigation activity in recent years.

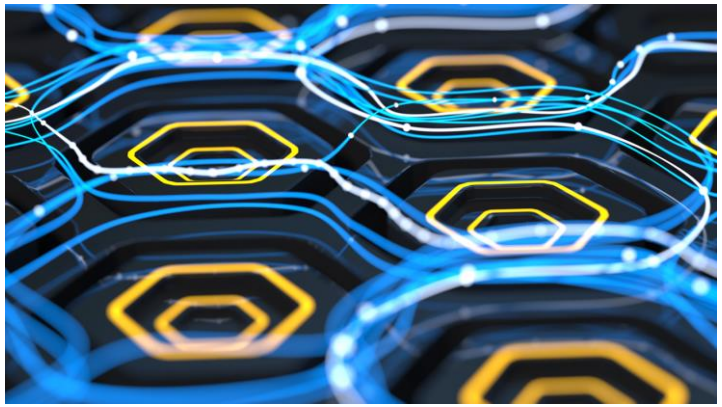
Obtaining a Patent Protection for Battery Innovations

- Requires battery companies to **file patent applications** with the **USPTO (for U.S. patents)**.

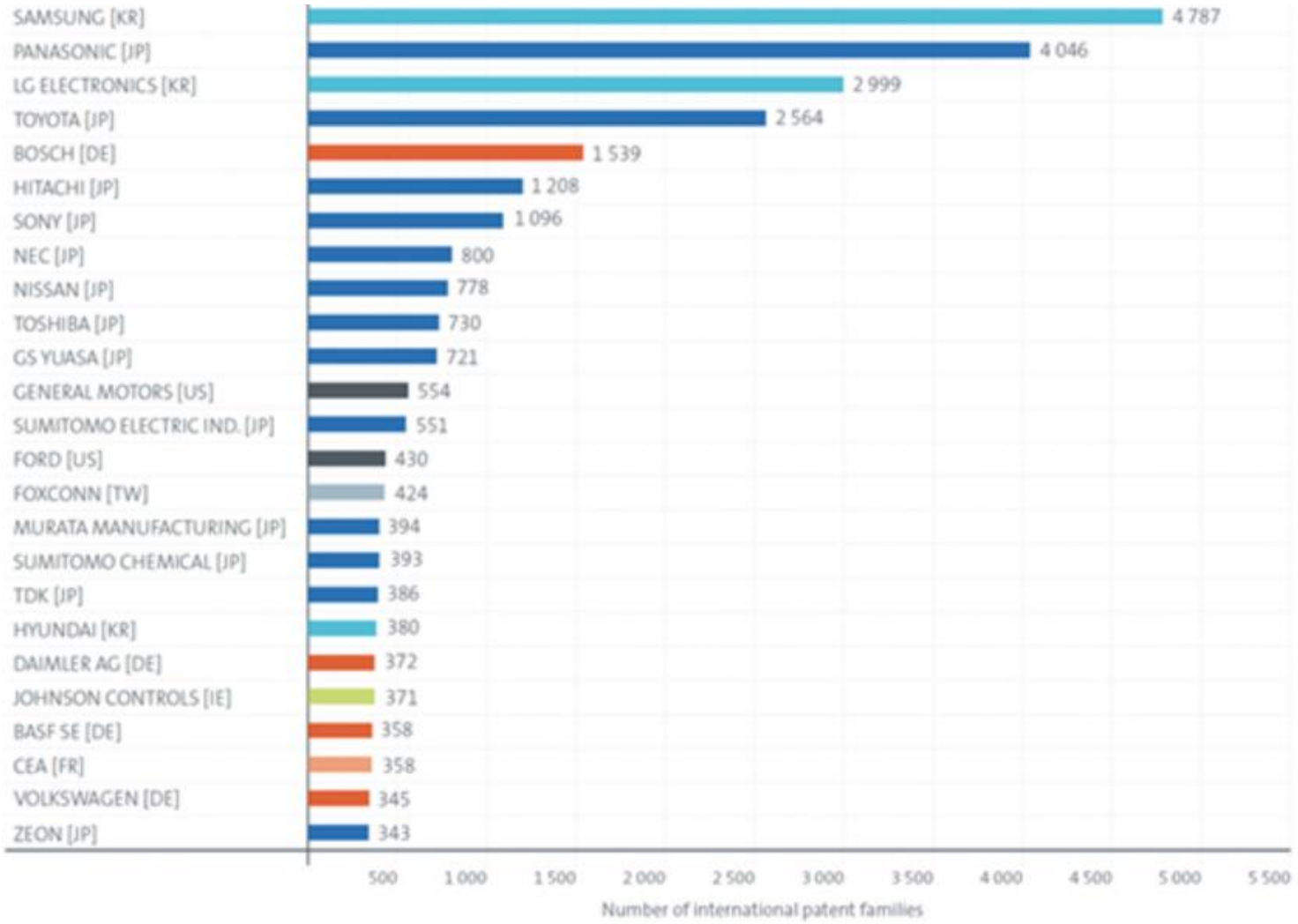
- While patent prosecution can be onerous for any company, there is some evidence that battery companies generally face **fewer obstacles** to obtaining patents than other companies in the EV sphere, particularly those **developing driverless AI technologies**. Unlike AI and other software-based innovations, batteries typically **do not raise subject matter eligibility issues**, thereby **avoiding** a hurdle to patent protection that is common in other corners of the EV industry.

- The **2019 average allowance rate** in **CPC Class H10M** was **82 percent**, which is actually higher than the overall USPTO average for all technologies.

- Some of the **most active** companies are LG Chem, Toyota, Samsung SDI, Hefei Guxuan High-Tech Power Energy, Panasonic, BYD, CATL, SK Innovation, Envision, Tesla, Wildcat Discovery Technologies, and QuantumScape.



Top Patent Owners



Top 25 Patent Applicants in Battery Technology, 2000-2018

Source: European Patent Office
https://www.epo.org/news-events/news/2020/20200922.html

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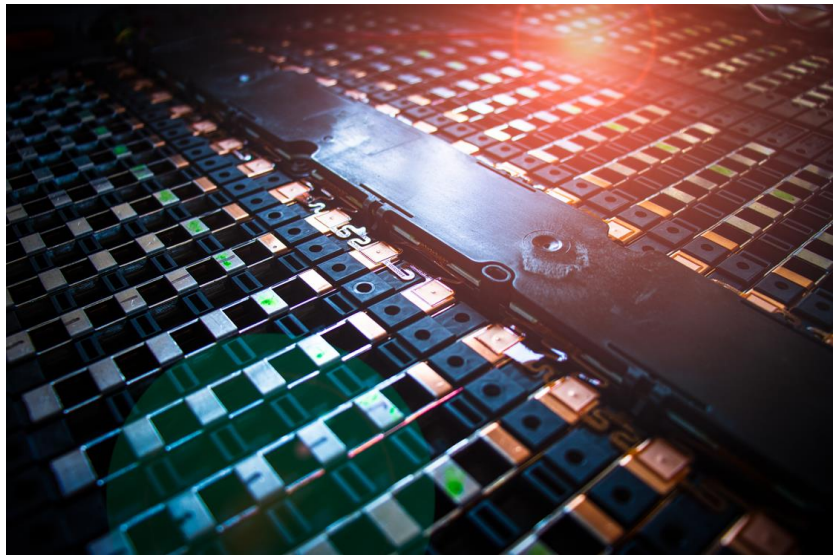
Patent Prosecution, Portfolio, and Strategic Patenting Considerations

- Battery and EV companies should focus on patent strategy beyond prosecution and enforcement.

- Companies should **align their patent strategy** with their **overall business plan** to ensure that a patent portfolio realizes its full economic potential and **generates revenue** for the company by protecting investments.

- Strategic considerations include what to patent *(battery management systems, battery components, cell assembly, manufacturing processes, or components),* where to patent, what patents to abandon or sell, and licensing strategies.



Key Considerations

One key strategic consideration in building a robust patent portfolio involves deciding in which countries to file the patent applications.

- With attorney fees, filing fees, potential translation fees (if filing in a non-English language jurisdiction), and annuity fees, among others, the costs of obtaining and maintaining a global patent portfolio can quickly add up.
- A popular option, especially in cases where it is not yet clear in which specific countries IP protection is needed, is to first file a Patent Cooperation Treaty ("PCT") application. A PCT application, which by itself does not provide any IP protection, provides an opportunity to later enter the national phase in designated countries/regions, namely by pursuing the patent application before the individual patent offices of designated countries/regions to obtain patent protection in those countries/regions.
- As for which countries to file in, there are several factors to consider (1) costs and relative ease/difficulty of filing and prosecution; (2) length of examination/ time to grant; (3) quality of examination; (4) ability to enforce one's patents once they are obtained

For battery-related patents in particular, it is important to consider where and how big the present markets are for the invention.

Key Considerations Continued

- **Additionally, one should ask several other important questions:** *Where are the customers located? Where is the competition located, and where does it manufacture its products? Where will the customers/competition be five, 10, or 15 years from now?*

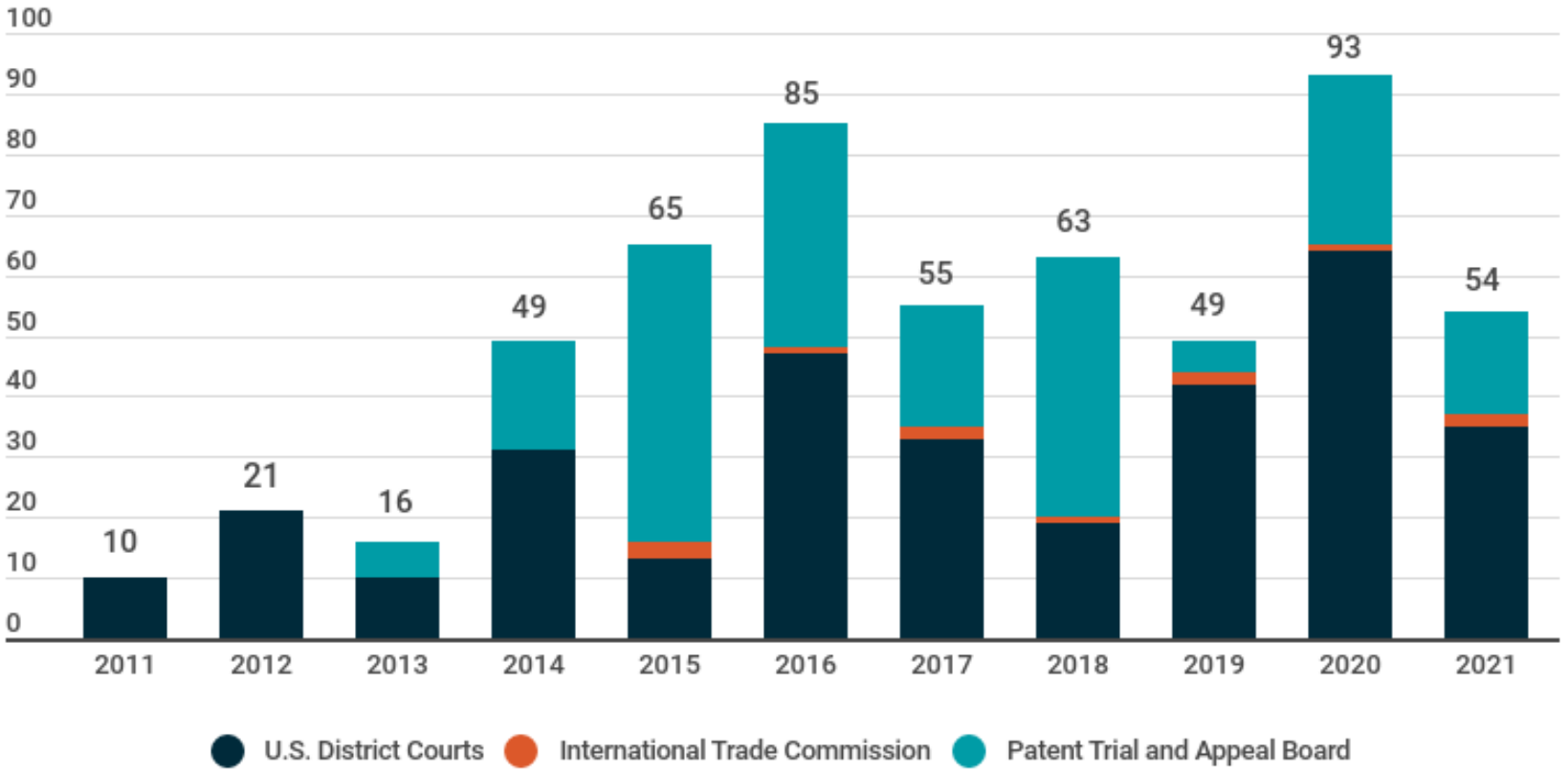
- Not surprisingly, the European Union, the United States, China, and Japan are popular options, although South Korea is another strong choice for battery-related technology given the large number of battery innovators that are based there.

- **Another key consideration involves deciding what aspect of the battery to patent:** *The entire system or specific components? Key materials such as anodes and cathodes? Perhaps specific manufacturing process?*

- While there is not a one-size-fits-all approach, it is worth keeping in mind that (1) proving infringement of a manufacturing process can be difficult, and (2) a patent that is directed to a larger system with many different components can be easier to design around in order to avoid infringement. Because each aspect is likely to require its own separate patent application, such decisions must be made carefully. Battery companies evaluating their IP strategy in the U.S. should also consider importation and supply chains, as a patent can serve as a tool to prevent importation (e.g., through enforcement at the ITC).

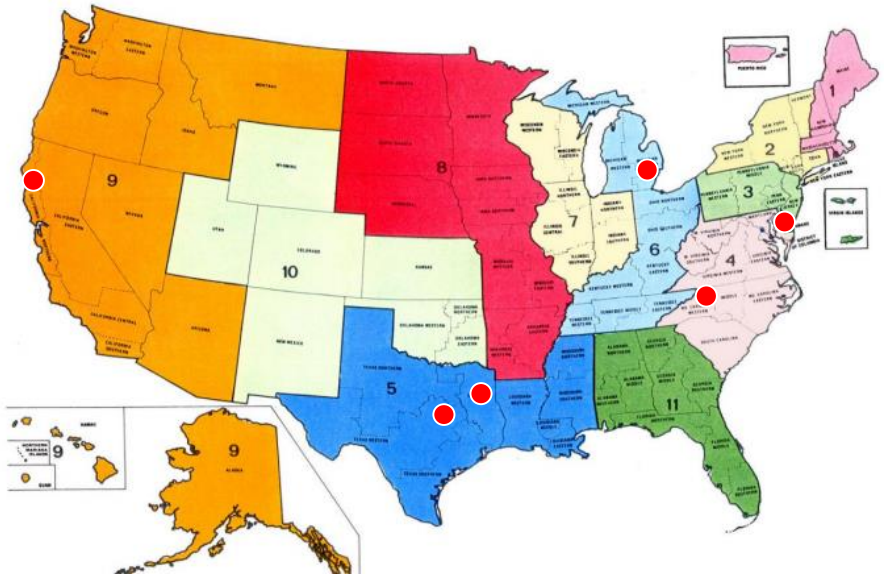
IP Enforcement and Litigation

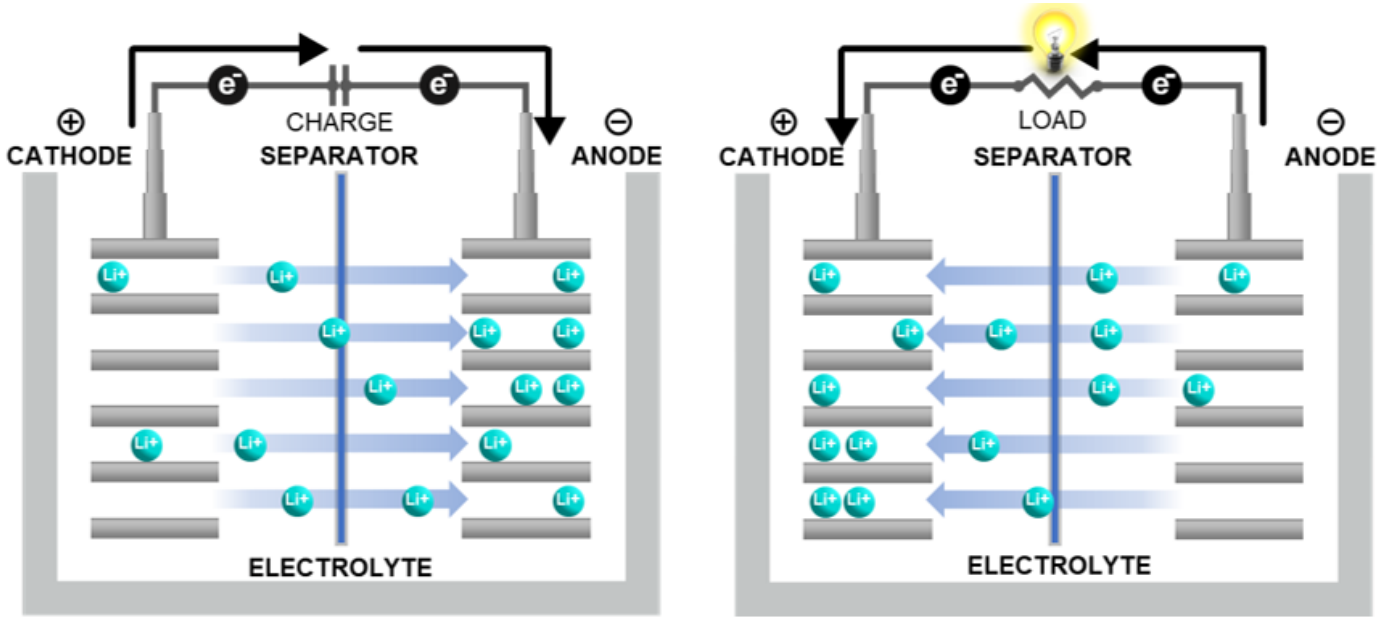
Battery Patent Litigation



Source: Docket Navigator as of 1/26/22

Battery Patent Cases in the U.S. District Courts





- **Cathodes:** BASF v. Umicore (Del.); LG Chem v. SKI (Del.); Maxell v. ATL (W.D. Tex.)
- **Anodes:** CF Traverse v. Amprius (N.D. Cal.)
- **Separators:** Celgard v. LG Chem (W.D.N.C.); LG Chem v. ATL (E. D. Mich.)
- **Electrolytes:** Advanced Electrolyte Techs. v. BYD Lithium Battery Co. (W.D. Tex.)
- **Cell packaging:** SKI v. LG Chem (Del.); Varta Microbattery v. EVE Energy (E.D. Tex.)
- **Module packaging:** SKI v. LG Chem (Del.)

Litigation Example: *Celgard v. LG Chem*

SUMMARY Of THE INVENTION

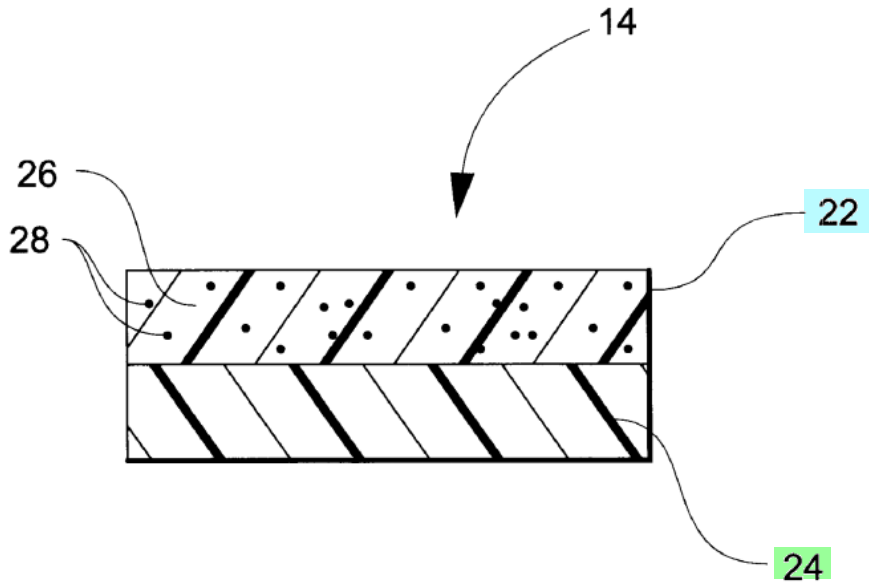
The instant invention is directed to a separator for a high energy rechargeable lithium battery and the corresponding battery. The separator includes at least one ceramic composite layer and at least one polymeric microporous layer. The ceramic composite layer includes a mixture of inorganic particles and a matrix material. The ceramic composite layer is adapted, at least, to block dendrite growth and to prevent electronic shorting. The polymeric layer is adapted, at least, to block ionic flow between the anode and the cathode in the event of thermal runaway.

* * *

Ceramic composite layer 22 comprises a matrix material 26 having inorganic particles 28 dispersed therethrough. Ceramic composite layer 22 is nonporous (it being understood that some pores are likely to be formed once in contact with an electrolyte, but ion conductivity of layer 22 is primarily dependent upon choice of the matrix material 26 and particles 28). …

1. A separator for a high energy rechargeable lithium battery comprises:

- at least one ceramic composite layer, said layer including a mixture of inorganic particles in a matrix material; said layer being adapted to at least block dendrite growth and to prevent electronic shorting; and
- at least one polyolefinic microporous layer, said layer being adapted to block ionic flow between an anode and a cathode.



US6432586B1 - Separator for a high energy rechargeable lithium battery - Google Patents

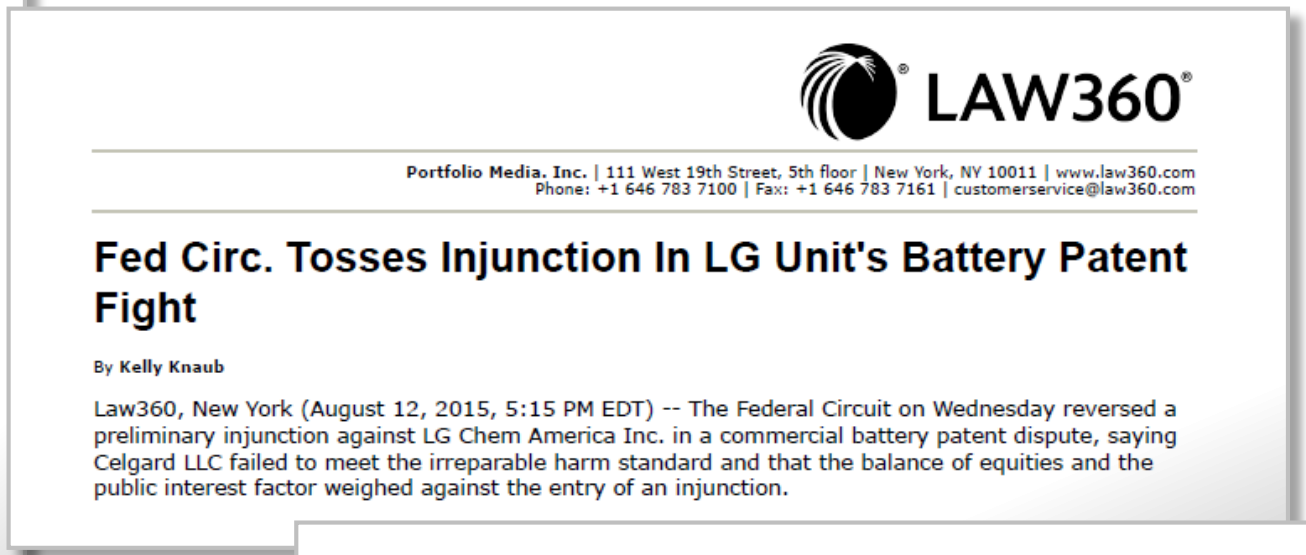
Litigation Example: *Celgard v. LG Chem*

yahoo!news

Polypore receives favorable ruling on preliminary injunction against LG Chem

July 21, 2014

Polypore announced that the United States District Court for the Western District of North Carolina has granted a motion by Celgard, a subsidiary of Polypore International, for a preliminary injunction against LG Chem, and LG Chem America. The judge's order granting the injunction is



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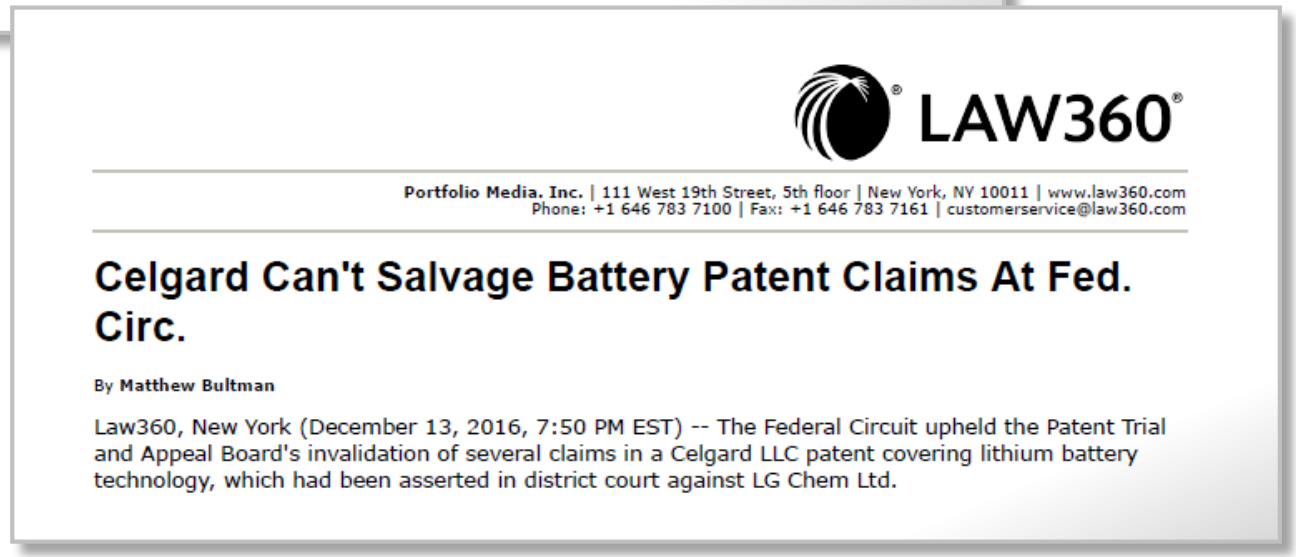
Fed Circ. Tosses Injunction In LG Unit's Battery Patent Fight

By Kelly Knaub

Law360, New York (August 12, 2015, 5:15 PM EDT) -- The Federal Circuit on Wednesday reversed a preliminary injunction against LG Chem America Inc. in a commercial battery patent dispute, saying Celgard LLC failed to meet the irreparable harm standard and that the balance of equities and the public interest factor weighed against the entry of an injunction.



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Celgard Can't Salvage Battery Patent Claims At Fed. Circ.

By Matthew Bultman

Law360, New York (December 13, 2016, 7:50 PM EST) -- The Federal Circuit upheld the Patent Trial and Appeal Board's invalidation of several claims in a Celgard LLC patent covering lithium battery technology, which had been asserted in district court against LG Chem Ltd.

https://www.yahoo.com/news/polypore-receives-favorable-ruling-preliminary-120820393.html

https://www.law360.com/articles/690250/print?section=appellate

https://www.law360.com/articles/872102/print?section=appellate

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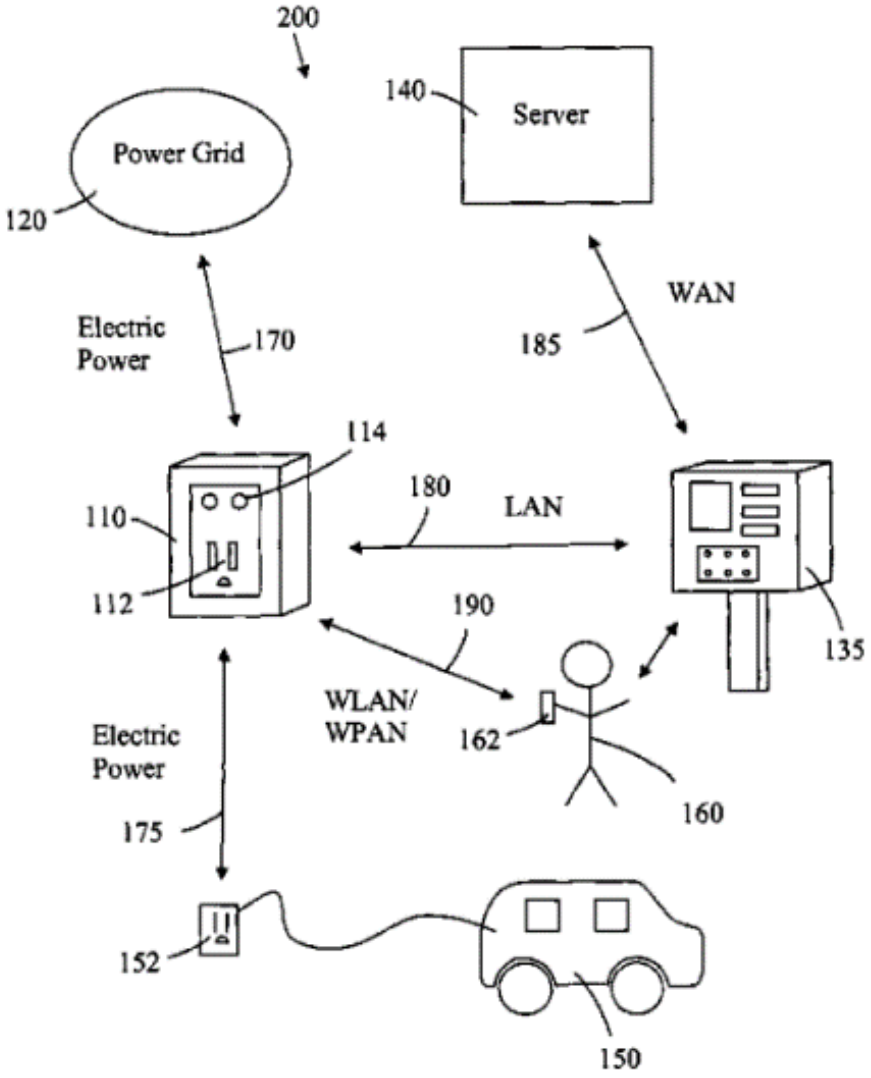
Litigation Example: *ChargePoint v. SemaConnect*

1. An apparatus, comprising:
a **control device to turn electric supply on and off** to enable and disable charge transfer for electric vehicles;
a transceiver to communicate requests for charge transfer with a **remote server** and receive communications from the remote server via a data control unit that is connected to the remote server through a wide area network; and
a **controller, coupled with the control device and the transceiver, to cause the control device to turn the electric supply** on based on communication from the remote server.

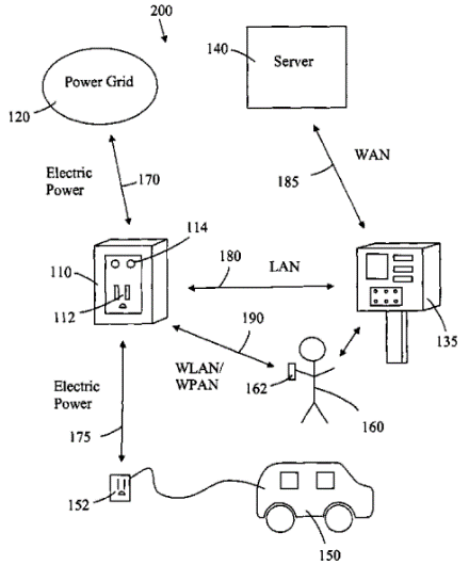


US8138715B2 - Network-controlled charging system for electric vehicles through use of a remote server - Google Patents

Litigation Example: *ChargePoint v. SemaConnect*

Whoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefor, subject to the conditions and requirements of this title.

35 U.S. Code § 101 - Inventions patentable



In short, looking at the problem identified in the patent, as well as the way the patent describes the invention, the specification suggests that the invention of the patent is nothing more than **the abstract idea of communication over a network for interacting with a device, applied to the context of electric vehicle charging stations**. *See Alice* , 573 U.S. at 222, 134 S.Ct. 2347 ("[T]he prohibition against patenting abstract ideas cannot be circumvented by attempting to limit the use of [the idea] to a particular technological environment." (alteration in original) (quoting *Bilski v. Kappos*, 561 U.S. 593, 610–11, 130 S.Ct. 3218, 177 L.Ed.2d 792 (2010))). Although this is not necessarily dispositive of the "directed to" inquiry, it strongly suggests that the abstract idea identified in claim 1 may indeed be the focus of that claim.

ChargePoint, Inc. v. SemaConnect, Inc., 920 F.3d 759 (Fed. Cir. 2019).

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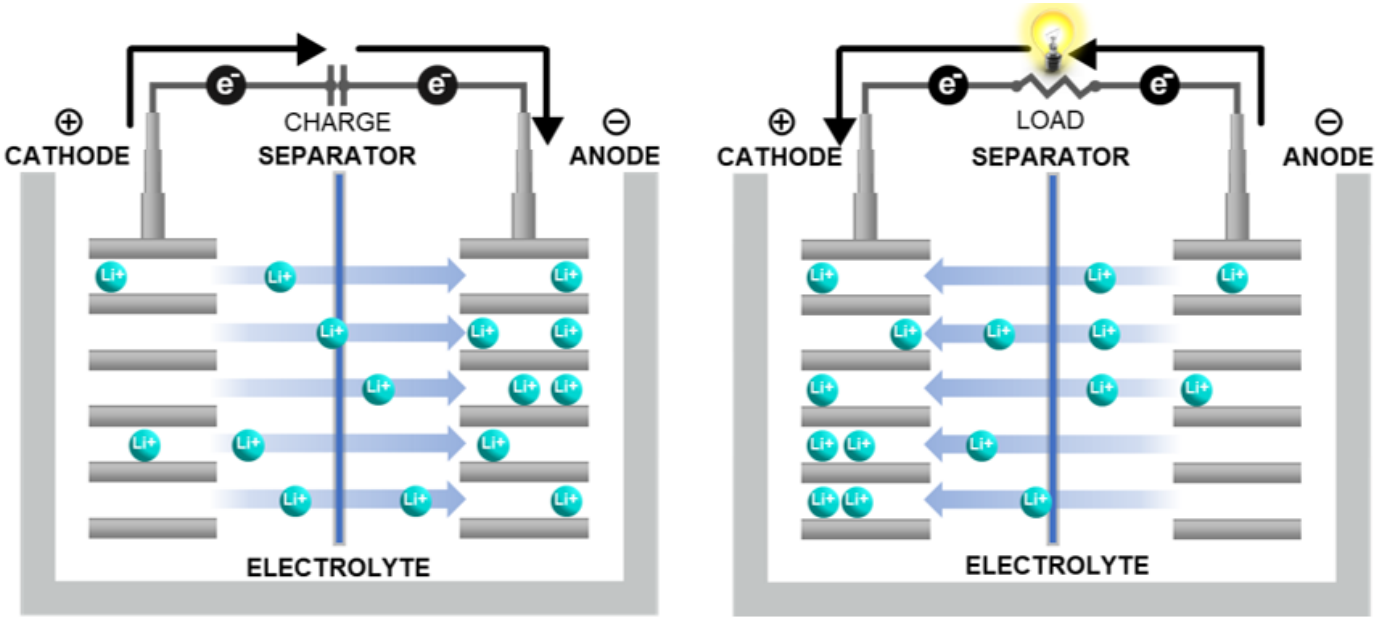
Battery Patent Cases in the ITC



- **Cathodes:** BASF/Argone v. Umicore; LG Chem v. SKI
- **Separators:** LG Chem v. ATL; LG Chem v. SKI
- **Cell packaging:** SKI v. LG Chem
- **Battery pack housing design:** One World Technologies / Techtronic Power Tools v. [numerous respondents]

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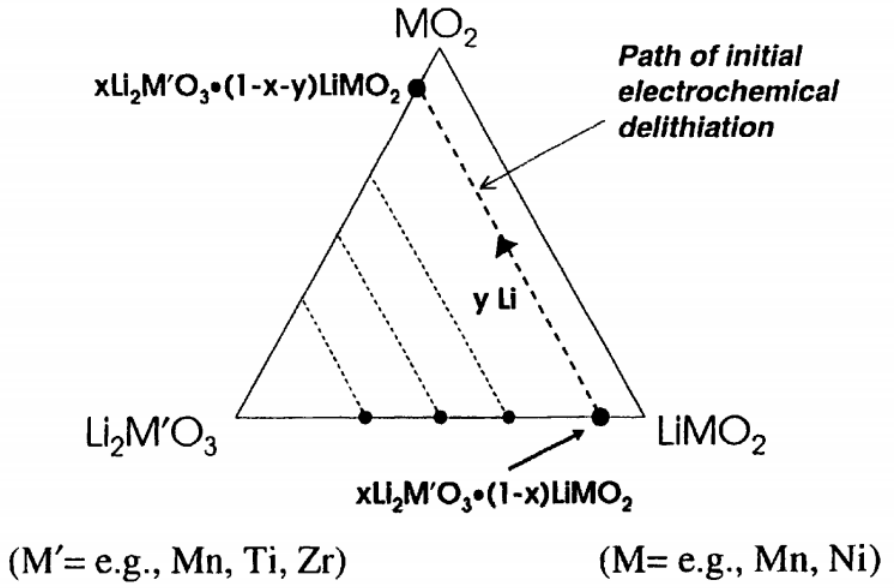
Litigation Example: *BASF v. Umicore*

- U.S. Patent No. 6,677,082 to Thackeray et al.
- Lithium Metal Oxide Electrodes for Lithium Cells and Batteries

1. A lithium metal oxide positive electrode for a non-aqueous lithium cell prepared in its initial discharged state having a general formula $xLiMO_2.(1-x)Li_2M'O_3$ in which $0<x<1$, and where M is one or more ions having an average oxidation state of three with at least one ion being Ni, and where M′ is one or more ions with an average oxidation state of four with at least one ion being Mn, with both the $LiMO_2$ and $Li_2M'O_3$ components being layered and the ratio of Li to M and M′ being greater than one and less than two; and **wherein domains of the $LiMO_2$ and $Li_2M'O_3$ components exist side by side**



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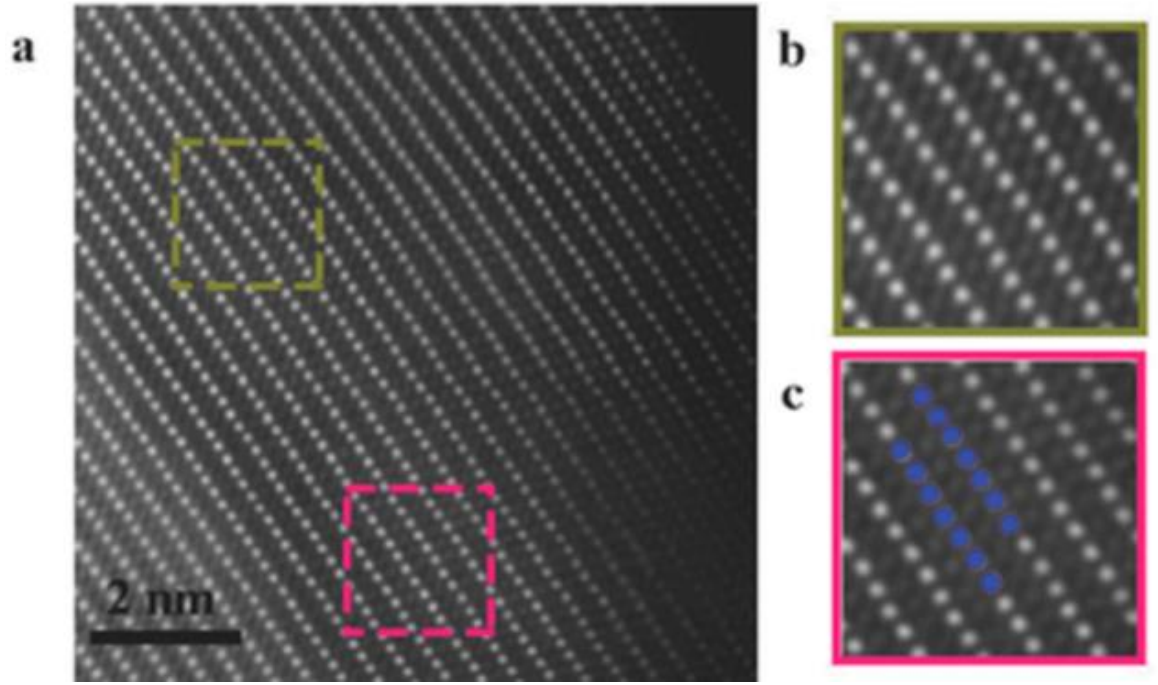
US6677082B2 - Lithium metal oxide electrodes for lithium cells and batteries - Google Patents

Litigation Example: *BASF v. Umicore*

- U.S. Patent No. 6,677,082 to Thackeray et al.
- Lithium Metal Oxide Electrodes for Lithium Cells and Batteries

https://en.wikipedia.org/wiki/European_Synchrotron_Radiation_Facility



Hu et al. (2018). Probing the Complexities of Structural Changes in Layered Oxide Cathode Materials for Li-Ion Batteries during Fast Charge–Discharge Cycling and Heating. Accounts of Chemical Research. 51. 10.1021/acs.accounts.7b00506.

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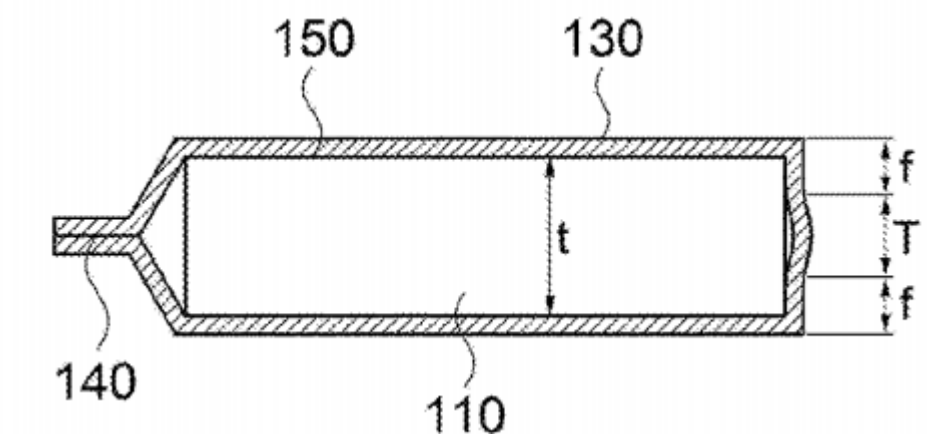
Litigation Example: *SKI v. LG Chem*

1. A secondary battery, comprising: an exterior material which includes a pouch film and a sealing portion formed at an outer side of the pouch film; and

an electrode assembly which includes a plurality of electrode bodies laminated with a separator interposed therebetween,

wherein a pair of forming portions are formed within the pouch film to house the electrode assembly, and

wherein the electrode assembly is packaged by the exterior material in a manner that three sides of the exterior material are sealed and one side is not sealed, and a thickness of the electrode assembly is larger than a sum of each depth of the pair of forming portions.



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US10121994B2 - Secondary battery and method for manufacturing the same - Google Patents

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Thank You!

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