

# **Nano One makes inroads into China through JV with cathode producer PuLead Technology**

Cathode powders have great potential to improve battery performance and they also account for a quarter of the cost of a typical battery cell. One type of cathode type popular in China, and dominant in heavy electric vehicles such as electric buses, is Lithium Iron Phosphate (LFP).

## **Lithium Iron Phosphate (LFP) batteries**

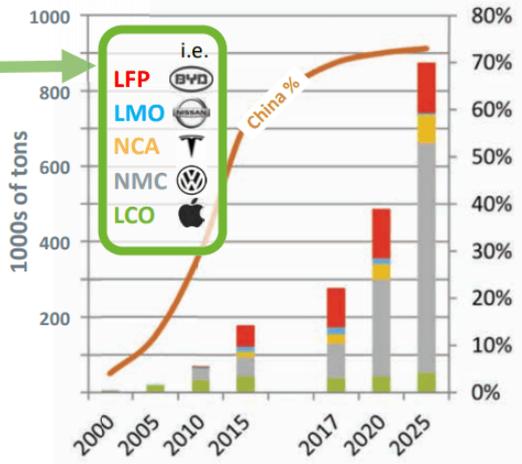
Highly durable, LFP does not contain supply constrained cobalt or nickel and is the safest and lowest cost cathode material for lithium ion batteries. Leading battery analysts believe market share will remain significant and that demand will continue to grow from 100,000 metric t in 2017 to 130,000 t in 2020 and over 200,000 t in 2025. Furthermore, cost reductions could significantly increase the demand for LFP as it becomes a cathode of choice for ESS (energy storage systems), as it replaces lead-acid batteries, and as it expands its foothold in the electrification of transportation.

# Nano One Cathode Market Opportunity

**NNO's flexible process makes all cathodes**

**Goal: Partner, License or JV with automotive and battery suppliers**

Worldwide LiB Cathodes Sales 2000-25 (kTons) Avicenne Energy 2018



← **\$23B Cathode Market (2025)**

## 2025 Projections

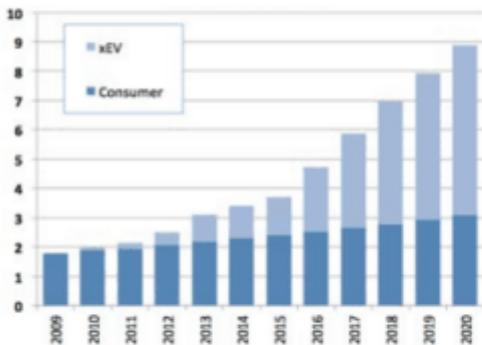
Avicenne Energy Data (2018)  
 520 GWh (4M EV/yr + other)  
 \$70B LiB Cells / \$95B Packs

- 75% EV (bus, car, truck)
- 9% Electronic Devices
- 5% Industrial (ESS, Grid)

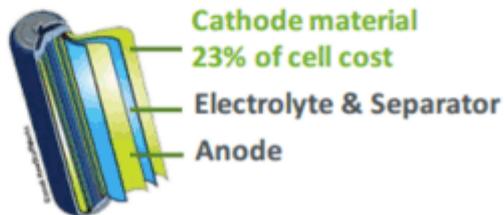
Nano One Materials Corp (TSXV: NNO) believes that cost effective production of nano-structured cathode materials can address pent-up global demand for better batteries. The challenge with any advanced material is to boost performance and reduce cost.

## High Growth Battery Materials Market

Global Lithium-ion Cathode Materials Market (\$US Billions)



- High Growth \$2-3B Market
- Concentrated in few Asian & EU producers



- Large new entrants eroding margins
- Vulnerable to disruptive technology
- Differentiating IP is critical
- \$100-500M/yr royalty opportunity



Over the last two years, Nano One's scientific team has developed an innovative process that simplifies the production of high performance carbon coated lithium iron phosphate cathodes (LFP). Most importantly, this technology improves operating and capital expenses by using lower cost raw material inputs with fewer process steps and by avoiding costly waste streams.

### **Nano One JV deal with Pulead Technology Co.**

Nano One is making inroads into China with its latest JV deal with Chinese cathode producer, Pulead Technology Industry Co. Without a doubt China will continue to be by far the world's largest battery market through its EV developments and energy storage industries. This shows why this is a huge deal for Nano One.

Headquartered in Beijing, Pulead operates at the leading edge of technology innovation in the development and manufacture of three kinds of electrochemical cathode active materials, namely LCO, LFP, and NMC; utilized in high performance lithium-ion batteries. Pulead is closely collaborating with global battery manufacturers such as Lishen and is now the supplier of choice for a range of industry leading multinational enterprises.

This Joint Development Agreement (the second for Nano One) has the objective to develop, evaluate, and optimize scaled up production of Pulead's lithium iron phosphate (LFP) cathode materials using Nano One's technology. Another part of collaboration will be to explore licensing and commercialization opportunities.

An excited Dan Blondal CEO of Nano One said: "Pulead is a highly respected cathode producer with a track record of partnering with international providers of intellectual property. By working together we aim to improve the cost and performance of LFP materials and to expand its use

in industrial batteries, e-buses, and electric vehicles. This agreement formalizes an important strategic relationship between Nano One and Pulead that began last year with visits, battery testing, and economic evaluation. This marks a key milestone in the execution of Nano One's business plan."

This JV is the latest of great news for the company as only last December 2018 they announced their first joint venture with a multi-billion Euro French multinational corporation Saint-Gobain. Saint-Gobain produces a wide variety of construction and high-performance materials for applications in automotive, aerospace, health, and energy. They have more than 179,000 employees, operate in 67 countries, and in 2017 had €40.8 billion in sales.

Dr. Yuan Gao, CEO of Pulead, added to the excitement by saying: "Pulead is excited to be working with Nano One and we are very encouraged by their ground-breaking innovations and capabilities. We look forward to fostering a profitable, long lasting, and collaborative working relationship."

The collaboration between Pulead and Nano One has the potential to provide a scalable manufacturing platform to address the anticipated market growth in LFP and provide both parties with increased margins. This latest JV and the one announced in December look very promising for Nano One. It is certainly a very exciting move to be entering into China, the heartland of EVs and lithium ion battery manufacturing.