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# BASF Battery Materials: Driving electromobility

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# Cautionary note regarding forward-looking statements

*This presentation contains forward-looking statements. These statements are based on current estimates and projections of the Board of Executive Directors and currently available information. Forward-looking statements are not guarantees of the future developments and results outlined therein. These are dependent on a number of factors; they involve various risks and uncertainties; and they are based on assumptions that may not prove to be accurate. Such risk factors include those discussed in the Opportunities and Risks Report from page 111 to 118 of the BASF Report 2017. BASF does not assume any obligation to update the forward-looking statements contained in this presentation above and beyond the legal requirements.*



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# BASF has the broadest offering to the automotive industry

Surface treatment, coatings, pigments

Headliner

Dashboard

Door side part

Window encapsulation

ABS cable

Air intake manifold, charge-air lines

Battery materials

Mounts for powertrain

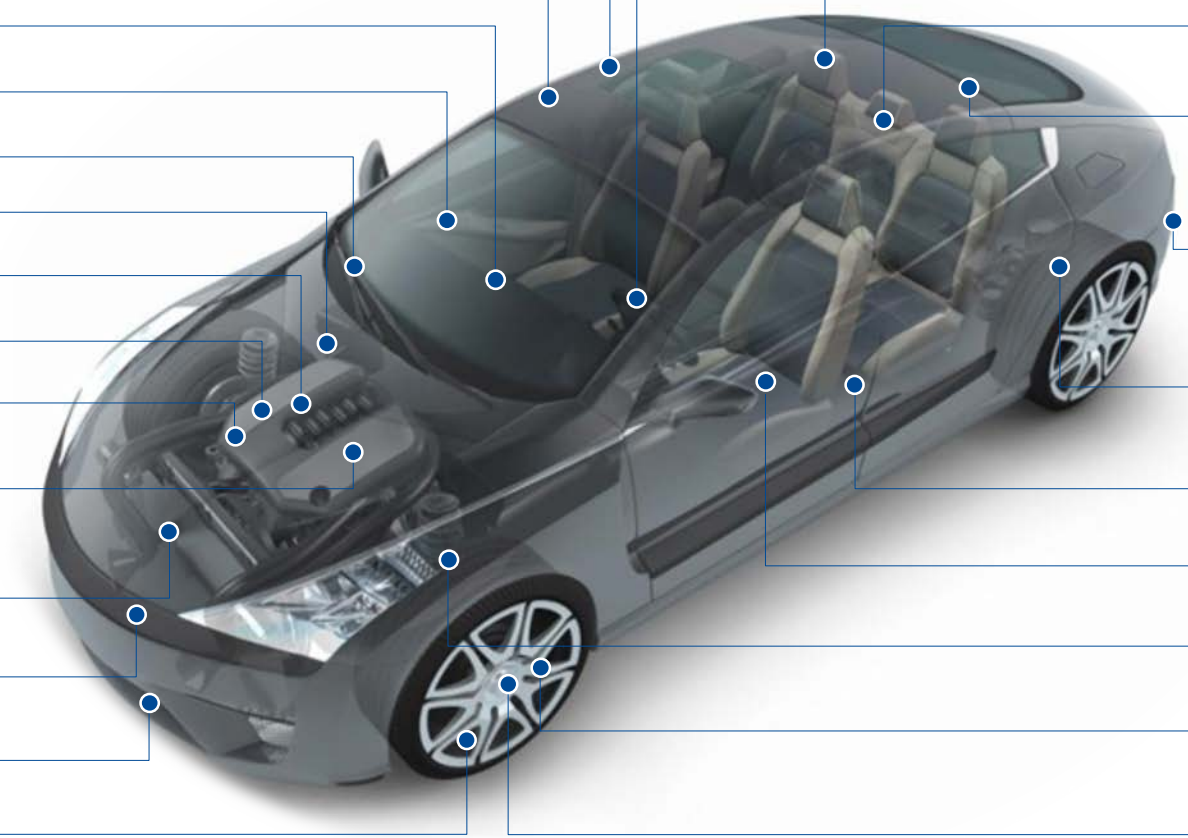
Lubricants, engine coolants, engine cover

Air-filter housing

Oil pan

Spoiler, lower bumper stiffener

Brake fluids



Steering wheel

Headrests

Roof module

Hatrack

Catalysts

Fuel additives

Carpet, floor mats

Seats, handrests, armrests

Cross beam

Wheel rim

Suspension: jounce bumper, top mount, coil spring isolator

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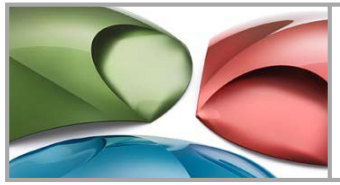
# Electromobility is a net positive for chemicals demand per car

| | Internal Combustion Engine (ICE) | | Battery Electric Vehicle (BEV) | |
|---|---|---|---|---|
| **Emissions control and power generation** | Catalysts | **Higher demand** | Cathode Active Material (CAM) | + |
| **Engineering plastics** | | **Higher demand** | | + |
| **Coolants** | Engine | **Comparable demand** | GLYSANTIN Battery | = |
| **Coatings** |  | **Comparable demand** | | = |



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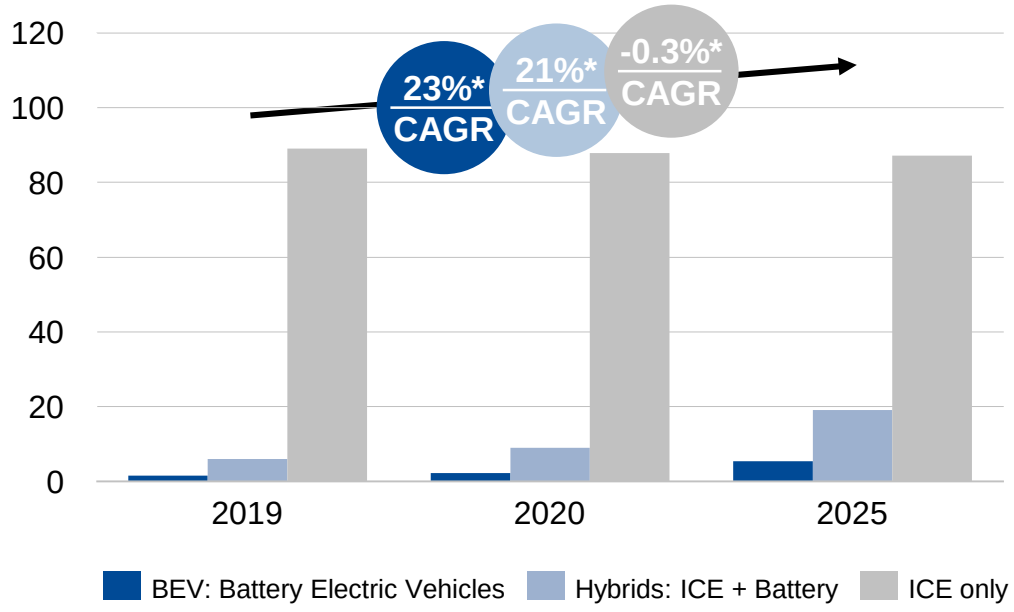
# BEVs and hybrids create opportunities in battery materials

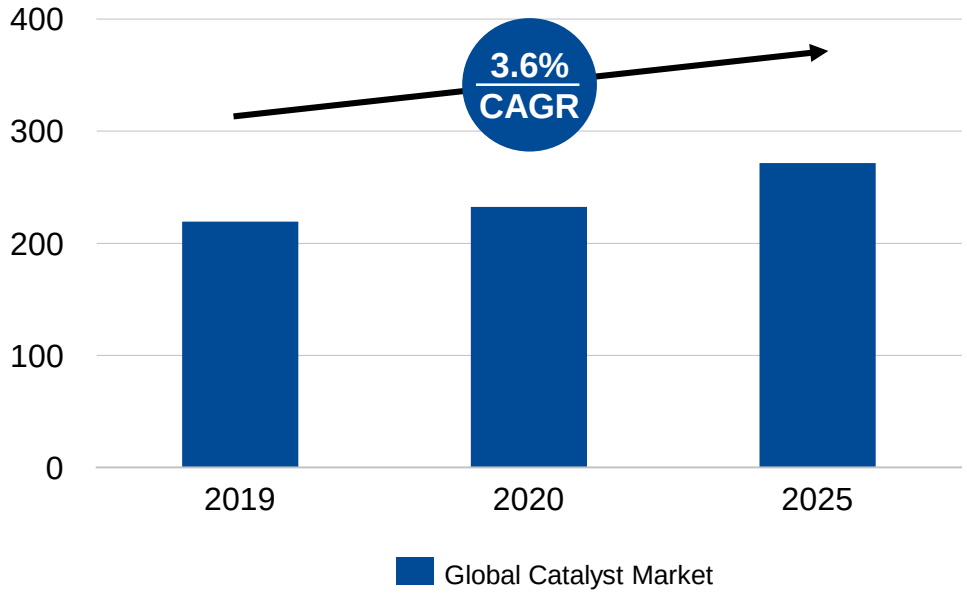
## But demand for catalysts will outgrow ICE** vehicle production for another decade

### Global vehicle production by engine type
million units




**BEVs with strongest growth rate, ICEs expected to stagnate**

### Mobile emissions catalysts market
million units




**Catalysts unit growth driven by regulations globally, further momentum from heavy duty, especially in Asia**



* Data source: LMCA ** ICE: Internal combustion engine

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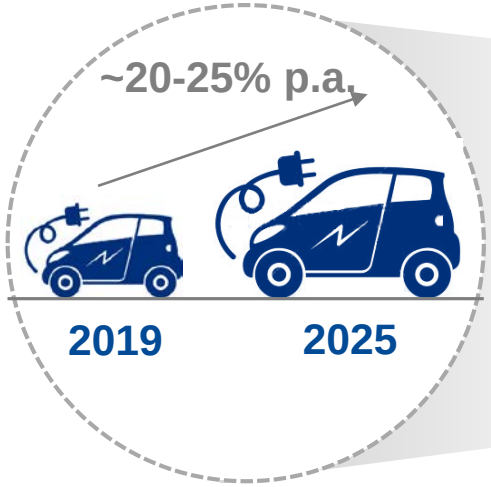
# Capturing the fast-growing battery materials market

**Electromobility drives battery materials growth**



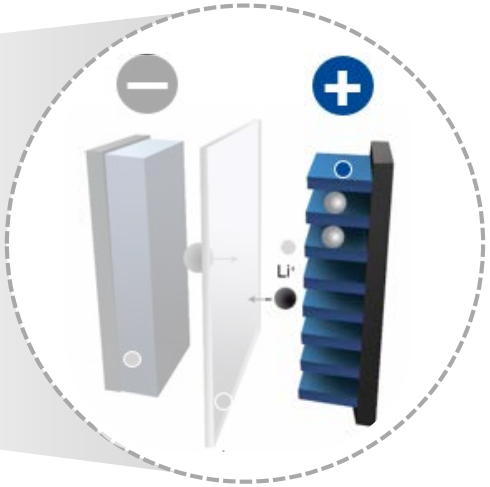

## Market projections for 2025*:

**10-15 million** electric vehicles built per year

**700-1,000 kt** of CAM in electromobility

**€25-30 billion** CAM market size

**Chemistry of cathode active materials is key to address electromobility challenges**





* Electric vehicles: BEV and PHEV; numbers capture various growth scenarios and BEV vs. PHEV ratios

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# BASF’s position in the battery value chain

## Battery cell chemistry defines the success of electromobility

| Mining | Metal refinery | BASF Battery Materials | Systems and applications | |
|---|---|---|---|---|
| Metal ore mining and upgrading | Metal salt solution and cast | CAM and precursors | Cells batteries | OEMs |

**Shaping the future of electromobility with cathode active materials**



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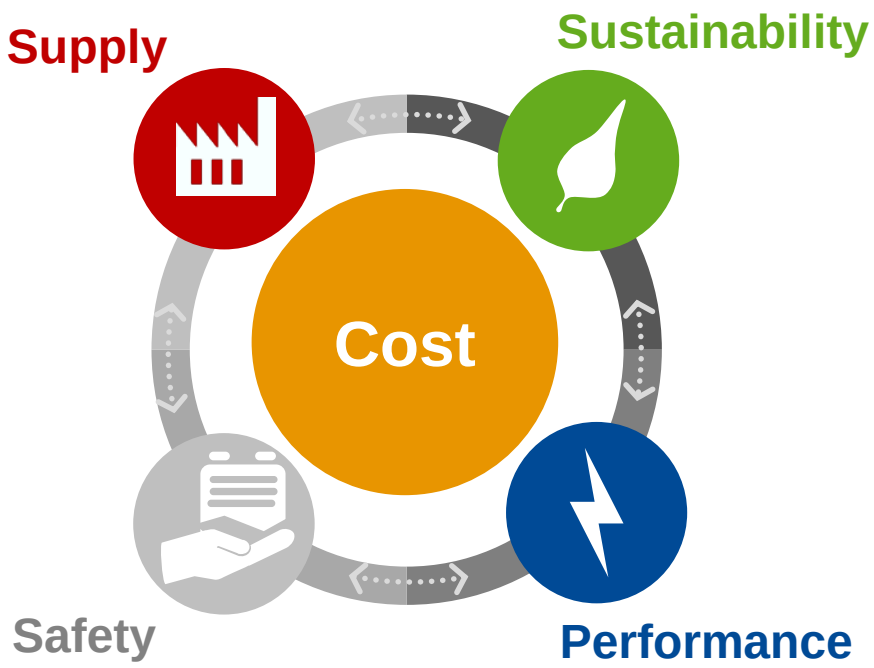
# BASF drives electromobility

## With holistic offer to address key customer needs




- Global manufacturing presence, regional footprint
- Innovative and reliable processes with highest single-train capacities
- Strong pipeline to invest for growth
- Secure supply chain

+

- Broadest commercialized portfolio of nickel-rich CAM
- Customer proximity of development teams
- Toolbox for CAM customization
- Strong product and process development pipeline
- Extensive IP portfolio



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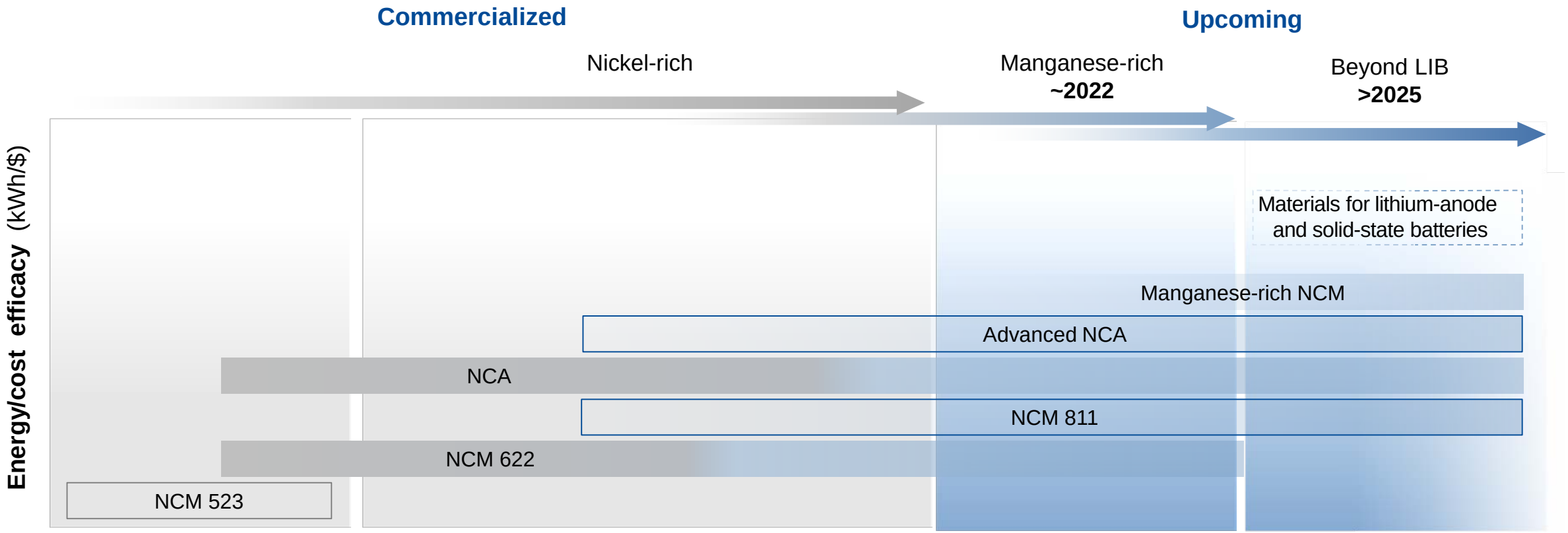
# BASF drives key cathode chemistries to improve energy density, lifetime and cost



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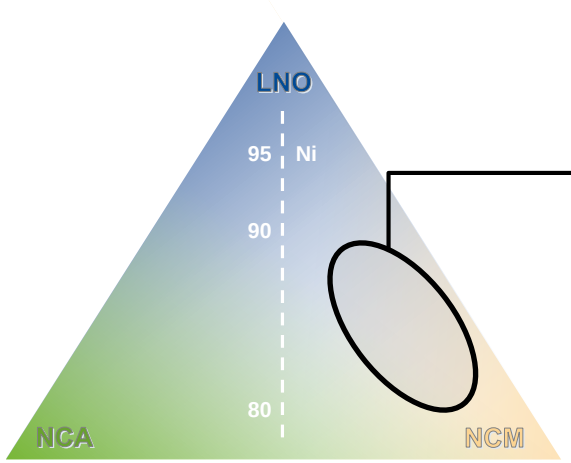
# BASF family of cathode active materials is matching all cell formats

## Comprehensive toolbox developed to further customize performance requirements

### Ni-based CAM families

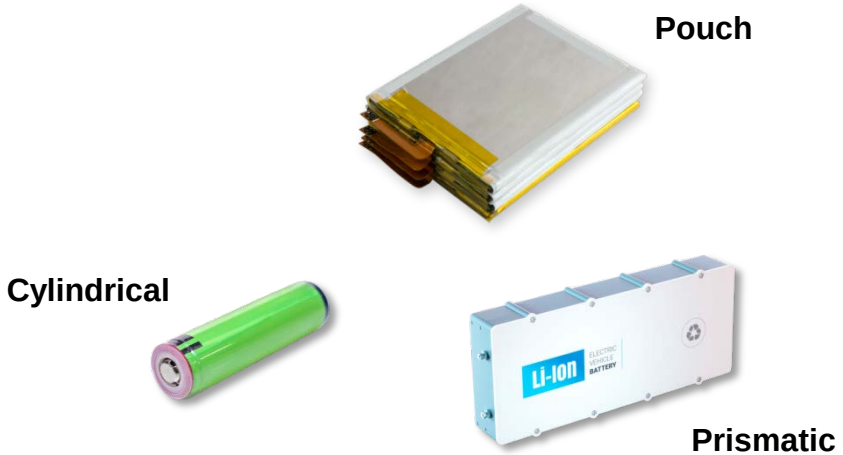



**Mn-rich CAM families**

**++ Cost benefit**
**- Stability challenges**

- Morphology, chemical composition and powder processing are key levers to achieve optimal performance
- CAM materials under development will need to provide optimized balance of energy density, cost and stability

### Cell formats




- BASF already supplies various CAM into all cell formats
- All future BASF CAM will be customized for optimized use in different cell formats



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# Fast-paced buildup of global CAM footprint and scale to win

## Already supplying leading cell producers and OEM platforms, secure supply to growing customer base

**2012**

First CAM production facility in Elyria, Ohio

**2018**

Second CAM production facility in Battle Creek, Michigan; merged with Elyria, Ohio into BASF Toda Americas (BTA)

**Europe planned greenfield production**

**2018**

First production volumes at Harjavalta, Finland

**China planned greenfield production**

**2015**

Foundation of BASF Toda Battery Materials (BTBM), Japan

**2017**

Tripled capacity at BTBM in Onoda, Japan



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# Latest news: European investments

## Foundation for a truly unique value proposition in Europe

BUSINESS & FINANCIAL NEWS | OCT 22, 2018

Joint News Release

### BASF and Nornickel join forces to supply the battery materials market

- **BASF announces first location for battery materials production in Europe**
- **BASF and Nornickel establish a strategic cooperation to meet the growing needs for battery materials in electric vehicles**

**Ludwigshafen, Germany, and Moscow, Russia, October 22, 2018** – BASF has selected Harjavalta, Finland, as the first location for battery materials production serving the European automotive market. The plant will be constructed adjacent to the nickel and cobalt refinery owned by Norilsk Nickel (Nornickel).

Short and reliable supply chain

Sustainable cobalt sourcing

Best $CO_2$ footprint

High local content



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# Latest news: China

## Further strengthening our footprint in Asia

BUSINESS & FINANCIAL NEWS | OCT 29, 2018

### BASF and SINOPEC sign Memorandum of Understanding to expand cooperation in China

Ludwigshafen, Germany and Nanjing, China – October 29, 2018 – BASF and SINOPEC have signed a Memorandum of Understanding (MoU) in Beijing to further strengthen their partnership in upstream and downstream chemical production in China. The partners intend to build an additional steam cracker and to further expand their existing 50:50 joint venture, BASF-YPC Company, Limited (BASF-YPC). A joint pre-feasbility study will be concluded by the end of 2018. Additionally, the two companies will jointly explore new business opportunities in China's fast-growing battery materials market.

The partners are also jointly exploring new business opportunities in battery materials. The rising importance of alternative energy in China, especially in the automotive industry, has led to a surge in demand for innovative battery materials for a range of applications.

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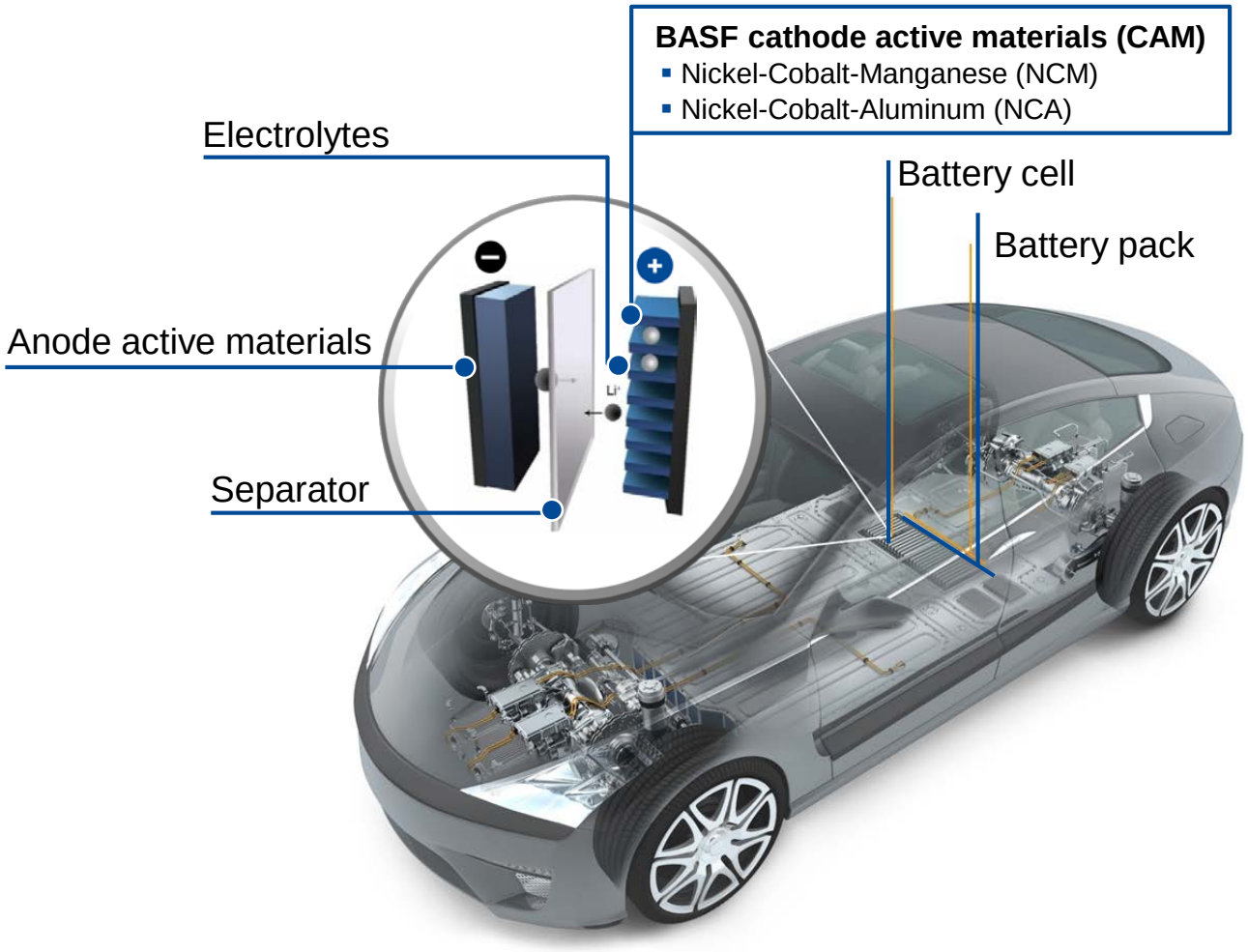
# BASF Battery Materials in pole position




- ✓ Broadest high energy density CAM portfolio
- ✓ Tailored solutions to strong customer base
- ✓ Established manufacturing know-how
- ✓ Strong innovation and growth pipeline
- ✓ Global presence and secure supply chain
- ✓ Long-standing strategic partnerships



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