umicore
materials for a better life

Introducing Umicore

Umicore NAATBatt March 2019

Who we are

A global materials technology and recycling group

One of three global leaders in emission control catalysts for light-duty and heavy-duty vehicles and for all fuel types

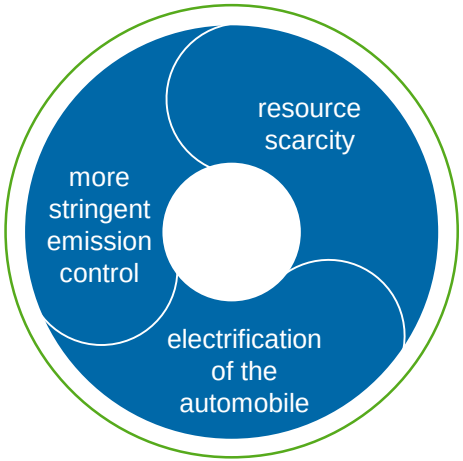
A leading supplier of key materials for rechargeable batteries used in electrified transportation and portable electronics

The world's leading recycler of complex waste streams containing precious and other valuable metals

Our foundations

Unique business model

Supportive megatrends



Industry leader in sustainability

Our strategy

horizon 2020

By 2020 we have…

clear leadership in clean mobility materials and recycling

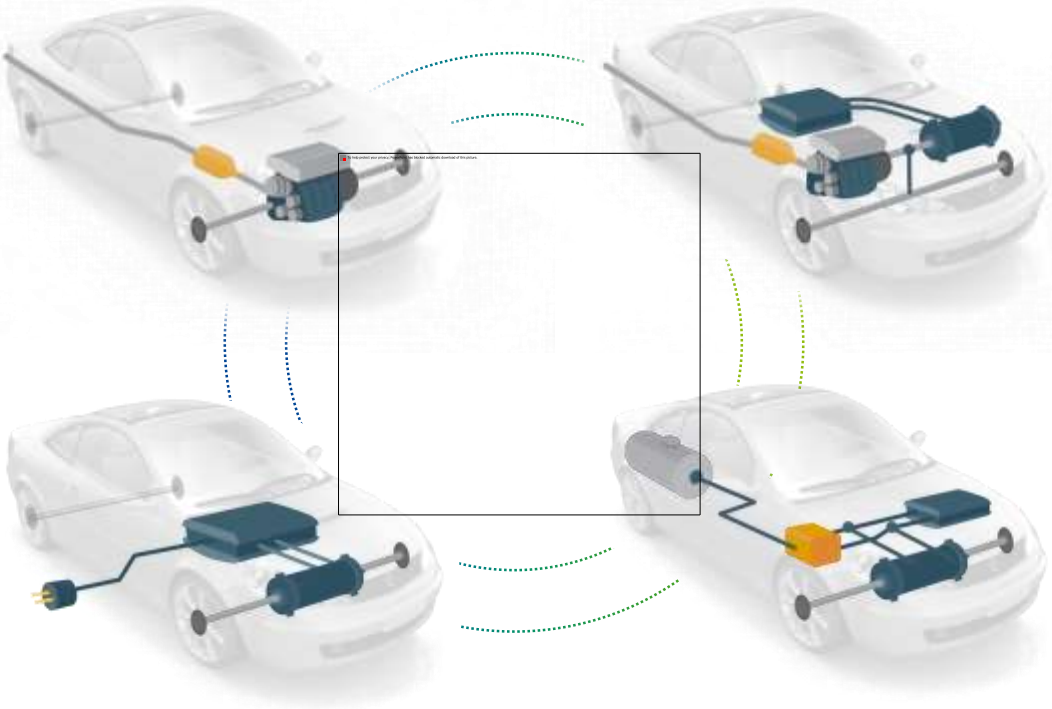
turned sustainability into a greater competitive edge

Unique position

in clean mobility materials

ICE
Emission control catalysts

(p)HEV
Battery materials and emission control catalysts

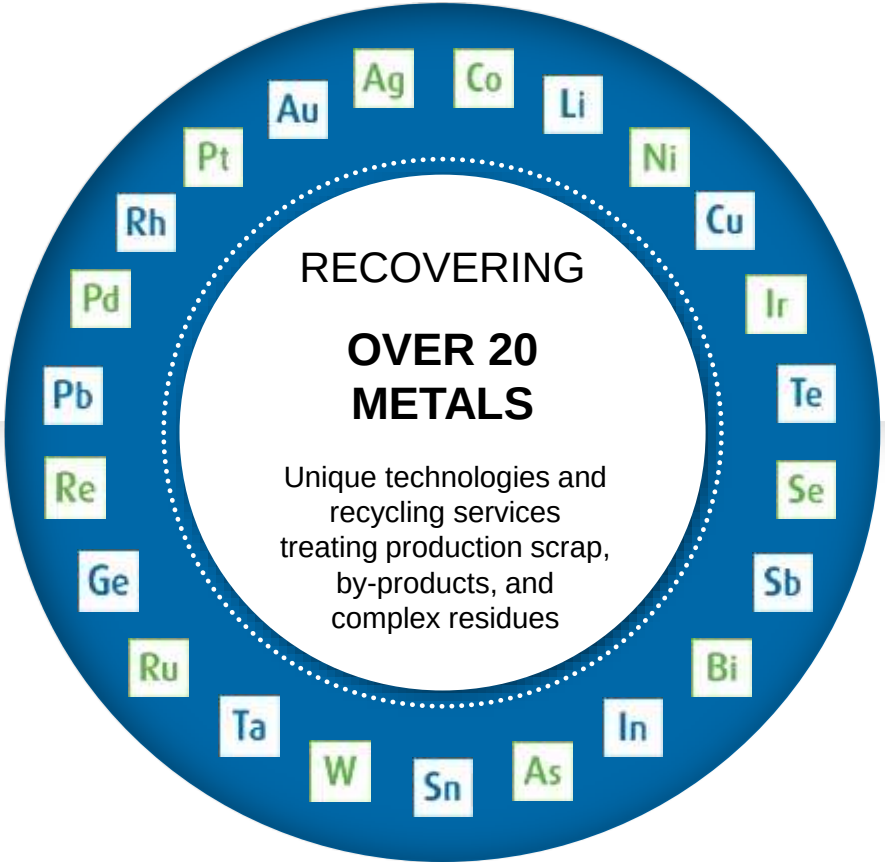


BEV
Battery materials

Fuel cells
Electro-catalyst and battery materials

Unique position

in recycling



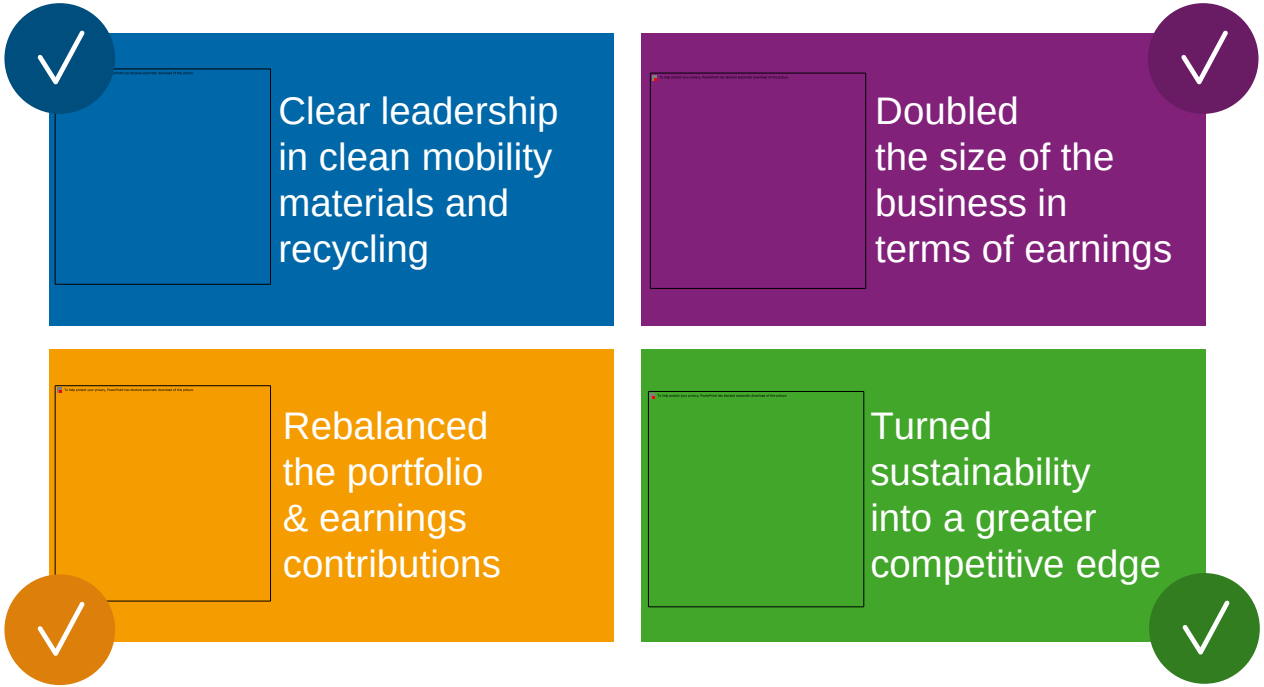
Turning sustainability

into a greater competitive edge

We have transformed Umicore into a sustainability leader over the past 15 years

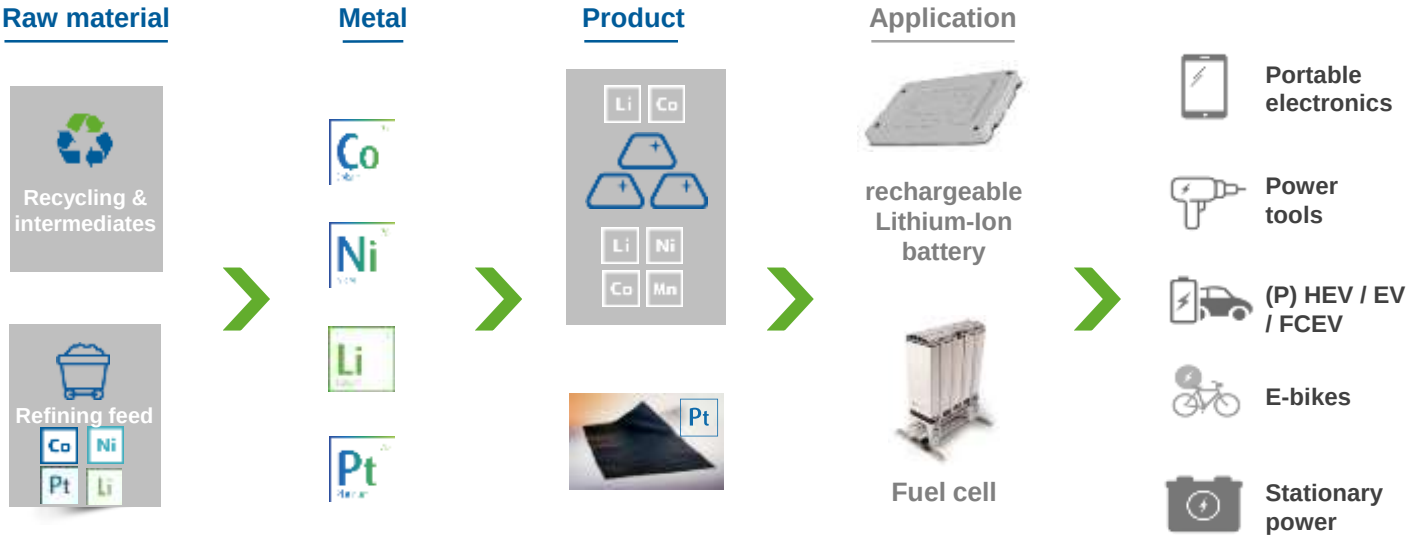
The purpose is to generate more concrete benefits from our sustainability efforts eg:

Delivering on our Horizon 2020 strategy



Umicore integration in battery & fuel cell value chain

Access to market, supply security, customer orientation



Umicore closes the material loop **by innovative recycling technology**

Closing the battery loop

- crucial to enable offtake of <u>sustainable</u> e-mobility

- Recycling is a **sustainable** source of Co & Li, driven by
  - Resource availability (complementing primary supply)
  - Responsible sourcing requirements
  - Environmental benefits (vs. mining)
    → reducing CO_2 footprint of e-mobility

- **Geographic diversification**, reducing dependence on DRC (60% mine production, ~50% of global reserves)
  - US is resource-rich if we consider our waste as “urban mine”

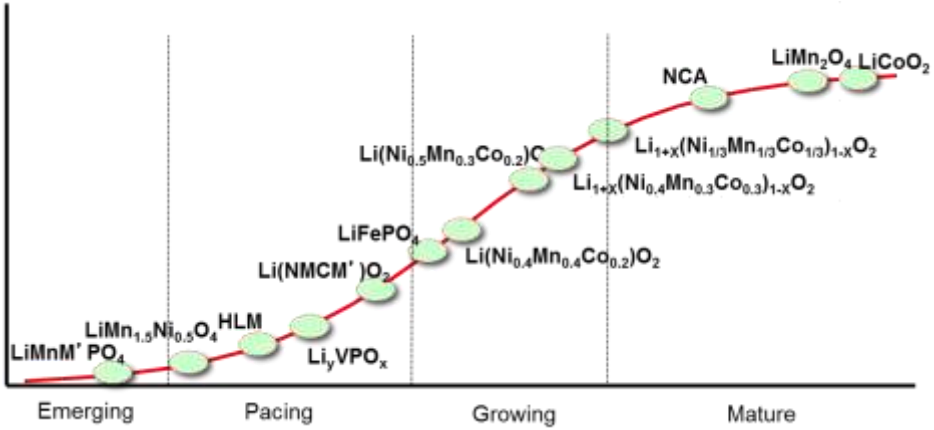
- Li-Ion battery recycling offers an additional source of Co even today.
  - Currently ~30,000mt per year Co used for portable electronics with very low returns (= 2 large mines or 3-4 Mio full EVs)

“Umicore Rechargeable Battery Materials is powering ahead with a new investment of € 660 million in China and Europe that will bring total capacity to at least 175,000 metric tons by 2021.”

Battery recycling requirements

- Basic technical requirements:
- High effective recycling rates → secondary metals need to fit for new (LIB-) products
- Environmentally sound & energy efficient recycling processes throughout the chain
- Safe handling of battery systems and recycling materials (→ electric charge, electrolyte)

- Economic requirements:
- Cost efficiency & economies of scale
- Handling of mass flows on industrial scale
- Flexibility in handling various battery types
- and chemical compositions



Experience in Industrial Scale Processing

Precious metals recycling
industrial scale
>1,350 t / day
500,000 t / year

Umicore

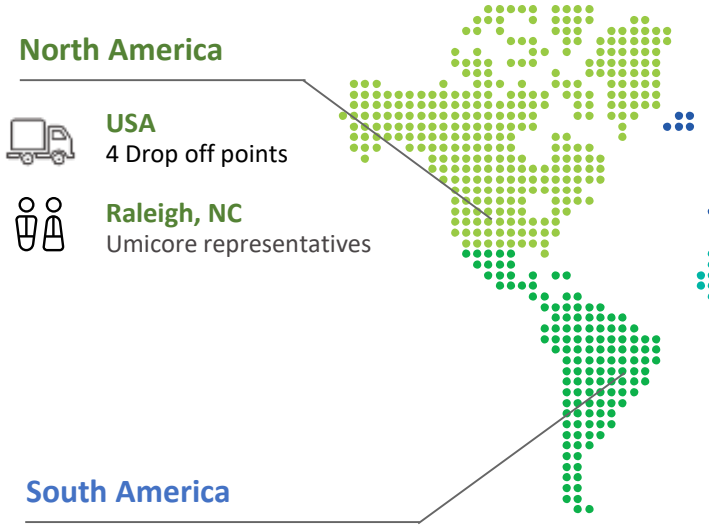
Battery recycling
industrial pilot scale

7,000 t / year

Delivers…

…experience and know-how to grow
from current to future high volume scale

Presence of Umicore Battery Recycling



North America

USA
4 Drop off points

Raleigh, NC
Umicore representatives

South America

Brazil
Drop off point

South Africa

Drop off point

Europe

Hanau, DE
Drop off point
Dismantling line

Hoboken, BE
Recycling plant UHT
7000 tpy capacity
€ 25M investment

Asia / Pacific

Umicore representatives
Japan-Korea-Australia- India

Drop off points
Thailand, Singapore, Taiwan, Hong Kong, Sri Lanka, China, Dubai

Other countries

Collaborations with local partners

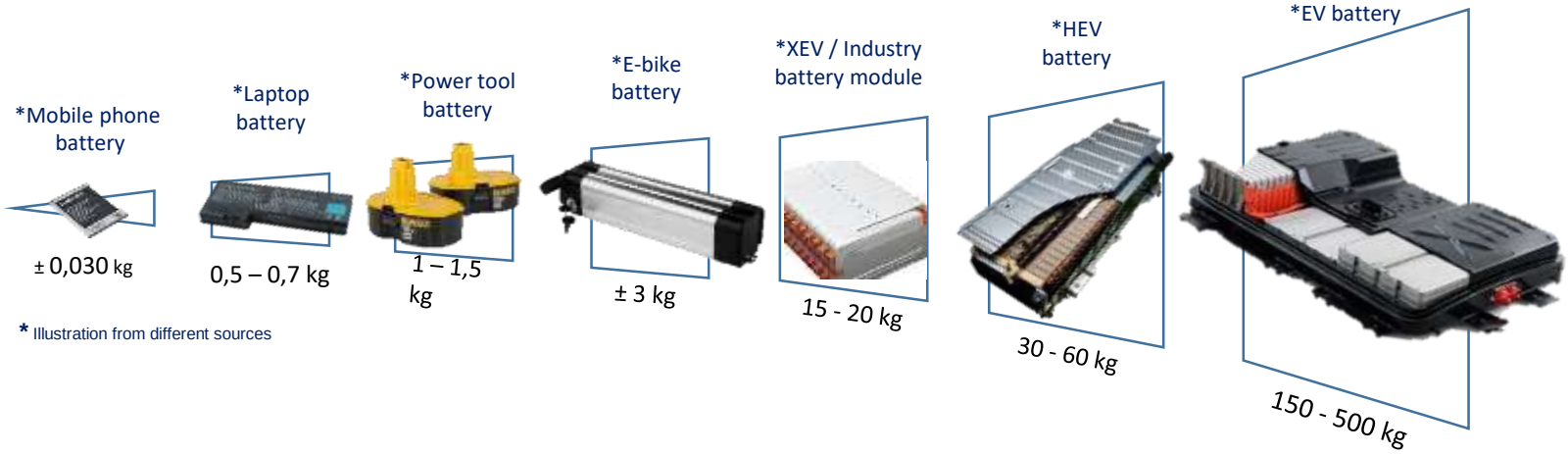
Variable feed size

Flexible on Size

- Medium sizes → directly to furnace
- Larger sizes after (partial) dismantling

No pre-treatment necessary = direct feed to the furnace

Pre-treatment necessary = dismantling to module/cell level



* Illustration from different sources

Umicore Recycling process for Li-Ion Batteries

Lithium is recovered in addition to Co, Ni, Cu on an industrial scale

Solution to the growing demand for sustainably sourced materials in a circular economy

Challenges for a circular battery business

- **Intrinsic success factors:**
  - Material value → battery chemistry & price development Co, Ni, Cu, Li
  - Battery composition & design; accessibility of battery in ELV
  - Business models (B2C vs B2B)

    → Battery lease to car owner, shared mobility, EV fleets/service model (B2B):

    → B2B creates inherent incentives for reparability/2nd life & quality recycling; critical mass/cost effectiveness @ industrial players; built-in transparency

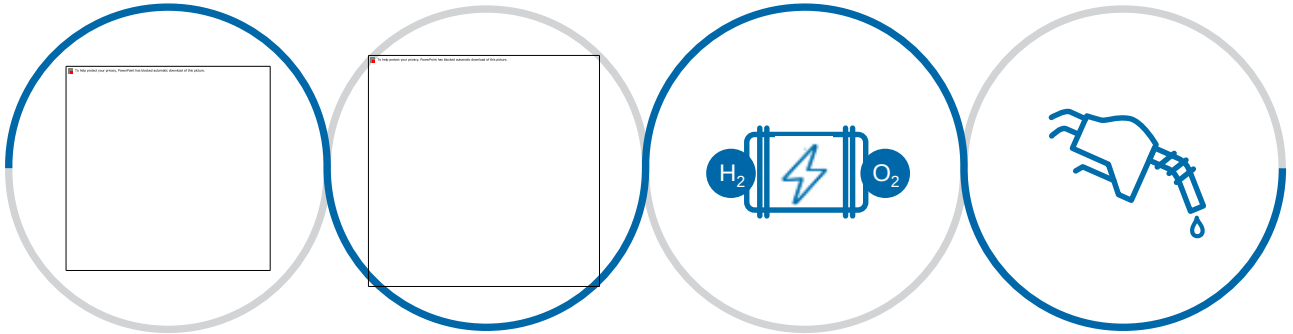
- **External success factors:**
  - Collection infrastructure, need responsible logistics companies
  - External collection, recycling incentives and regulator support
    → deposits, fees, EPR systems, public procurement…?
  - Quality & economic viability of recycling processes

    → technical & environmental performance; available quantities/economies of scale
  - Legislation / monitoring / enforcement → securing comprehensive & sound recycling
  - Stakeholder collaboration → OEMs, retailers, users, take back schemes, recyclers

No recycling without collection and feed into suitable processes!

Preparing the ground for further growth

Clean Mobility innovation roadmap spanning the next 20 years



Full electric

Plug-in hybrid

Fuel cells

Cleaner combustion engines

Battery Recycling gaining traction

Annexes

Global presence:

PEOPLE
10,420

PRODUCTION SITES
48

R&D | TECHNICAL CENTERS
14

North America

838 people

11 production sites

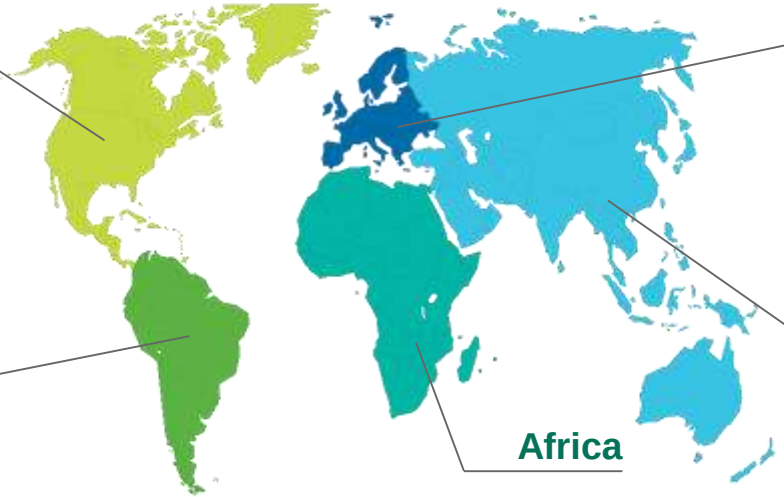
2 R&D technical centers

South America

678 people

5 production sites

1 R&D technical center



Europe

5,723 people

17 production sites

5 R&D technical centers

Asia / Pacific

2,922 people

14 production sites

6 R&D technical centers

Africa

259 people

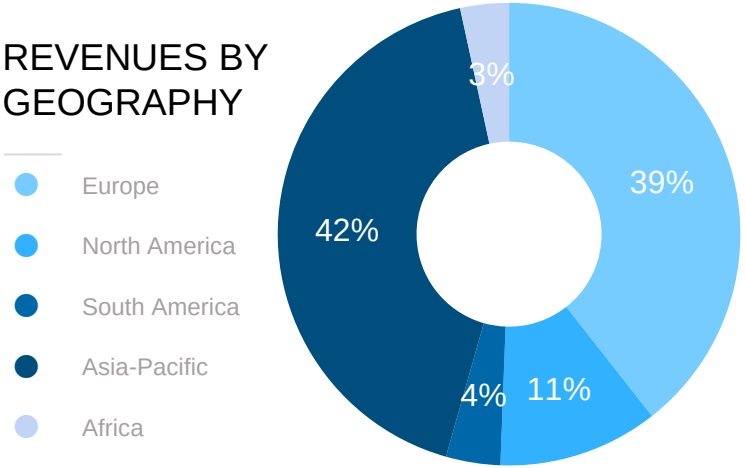
1 production site

Figures exclude associated companies (December 2018)

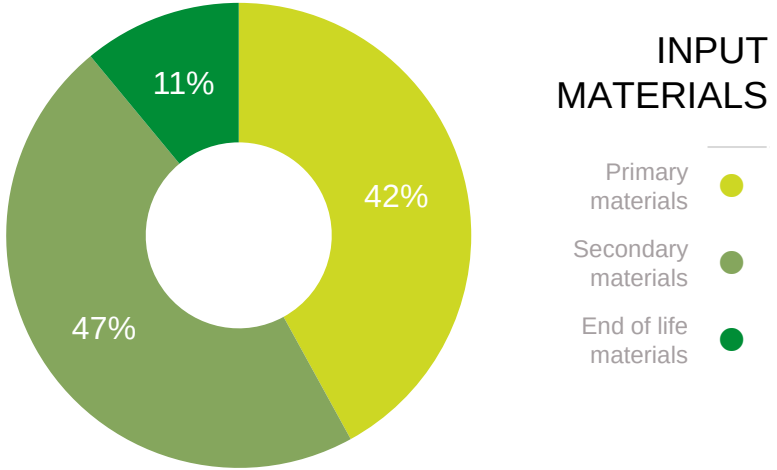
Key figures 2018

Revenues	Recurring EBIT	Recurring EPS	R&D spend
€ 3.3 bn	**€ 514 m**	**€ 1.36/share**	**€ 196 m**

REVENUES BY GEOGRAPHY



INPUT MATERIALS



Our strategic ambitions

are supported by

Unique business model

Strategic positioning

Strong commitment to innovation

Solid financial structure

Clear leadership in clean mobility materials and recycling

Turn sustainability into a greater competitive edge

Our strategic ambitions

are supported by

Our Group structure

CATALYSIS

Automotive Catalysts

Precious Metals Chemistry

ENERGY & SURFACE TECHNOLOGIES

Cobalt & Specialty Materials

Electroplating

Electro-Optic Materials

Rechargeable Battery Materials

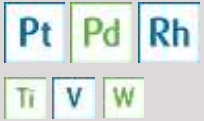
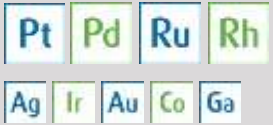
RECYCLING

Jewelry & Industrial Metals

Precious Metals Management

Precious Metals Refining

Catalysis overview

Automotive Catalysts	A world leader in emission control catalysts for light-duty and heavy-duty vehicles for all fuel types. Now also including non-road heavy-duty diesel catalysts and stationary catalysts for industrial plant emissions control.	
Precious Metals Chemistry	Developer and producer of metal-based catalysts used in chemistry, life sciences and pharmaceutical applications.	

Energy & Surface Technologies overview

Cobalt & Specialty Materials	Producer of cobalt and nickel specialty chemicals for a wide range of applications, including tires, pigments, catalysts and surface treatment. Now also responsible for proprietary Li-ion rechargeable battery recycling technology.	Re Co Ni W Ta Cu Li
Rechargeable Battery Materials	A leading cathode material supplier for lithium-ion rechargeable batteries used in portable electronics and electrified vehicles.	Ni Co Li Mn
Electroplating	Supplier of precious metal electrolytes & processes for technical, functional and decorative applications.	Au Ag Rh Ru Pd Pt
Electro-Optic Materials	Supplier of products for thermal imaging as well as wafers for space solar cells and high brightness LEDs and chemicals for fiber optics. Now also producer of evaporation material and sputter targets for optics and microelectronics industry.	Ge Se Pt Si Ti W

Recycling overview

Precious Metals Management	Services for hedging, leasing, purchasing and sale of precious metals to internal and external customers.	Ag Pt Au Ir Ru Pd Rh
Precious Metals Refining	Operator of the world's most sophisticated precious metals recycling facility able to recover 17 precious and other valuable metals from complex waste streams.	Ag Te Sb Ir Pt Bi Pb Au Sn In As Ni Se Ru Pd Rh Cu
Jewelry & Industrial Metals	Supplier of precious metals creating products for the jewelry and industrial sector and specialist in the manufacturing of platinum group metals components for the special glass and chemical industries, offering recycling solutions.	Ag Au Pt Pd Rh

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