



Research and Development

Denis Goffaux – CTO

Capital Markets Event on Recycling – 18-19 Nov 2010

Agenda

R&D organisation

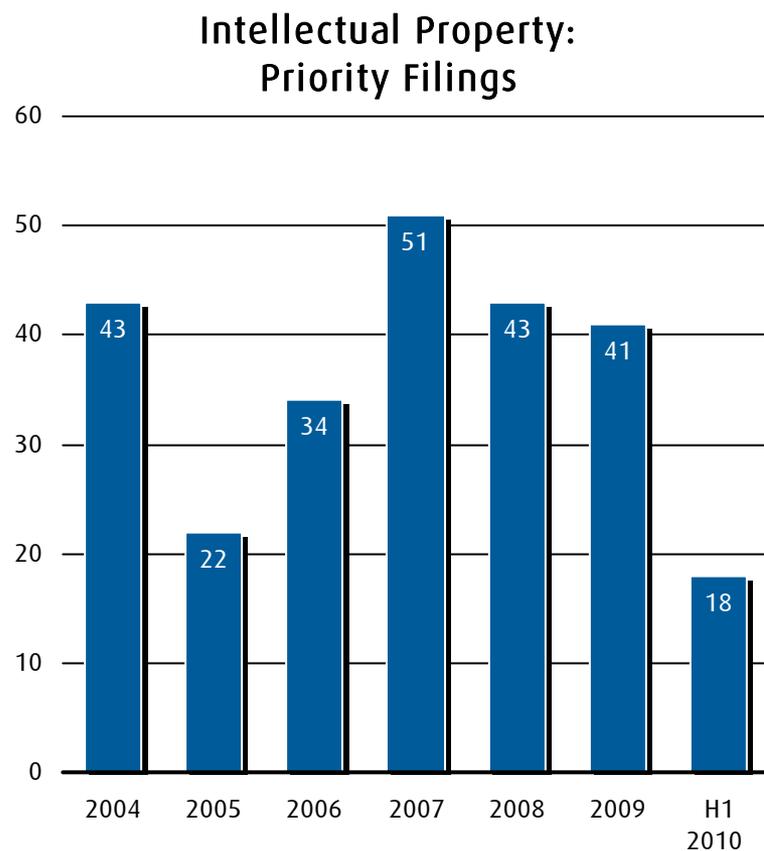
R&D technology portfolio

How R&D serves the recycling business

R&D organisation

Research & development

Key points



CTO responsibility

- Direct responsibility over Group R&D and EHS
- Technology advisor to ExCom and business units

Patents

- Patent families: 426
- Pending patents: 1,775
- Granted patents: 1,765

Research & development

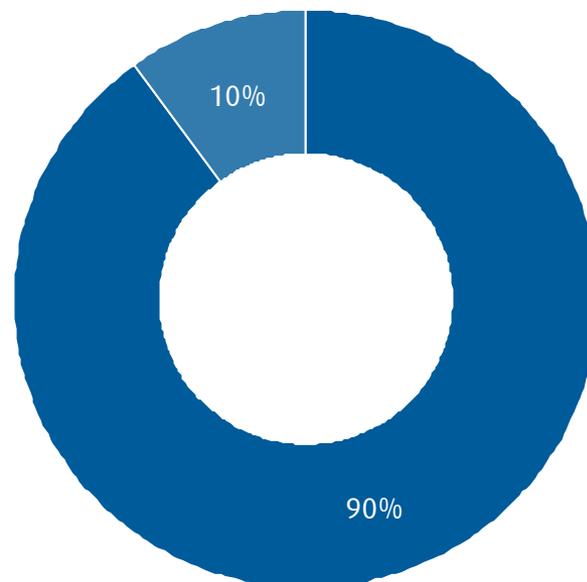
Key points

Research & development current headcount of 889 people (of which 236 in associates)

- 29% in Group R&D
- 71% in business units

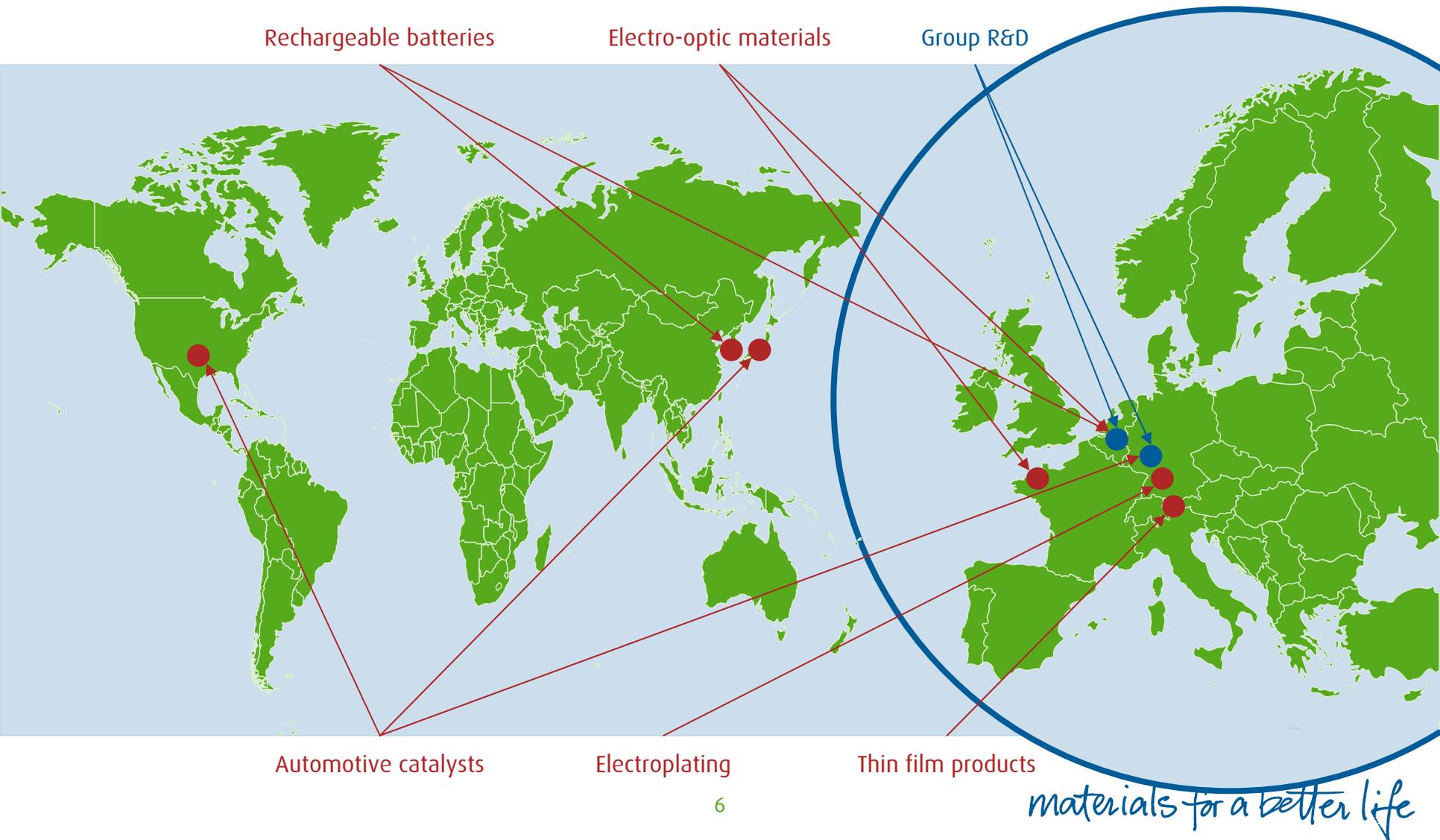
R&D expenditure at some 7% of revenues

- Total of €144 million in 2009 (including associates)
- Close to 90% of expenditures in clean technologies



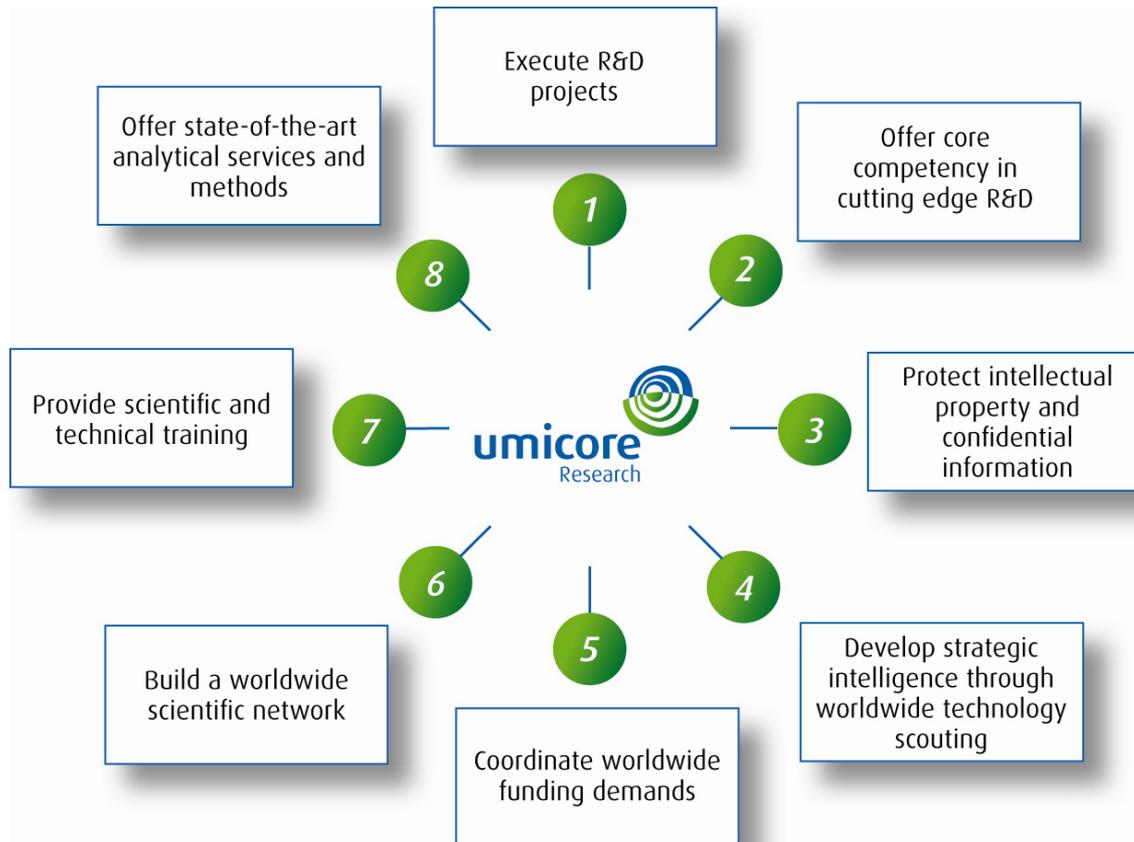
■ Clean technologies ■ Others technologies

Research & development locations



Research & Development

Our key activities



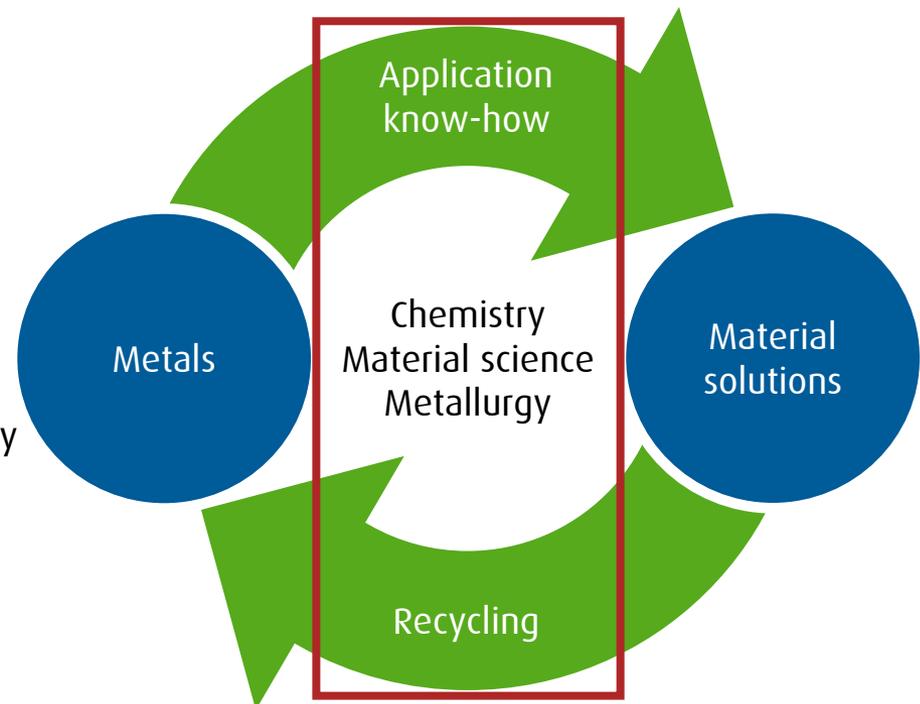
Technology

At the core of Umicore's business model

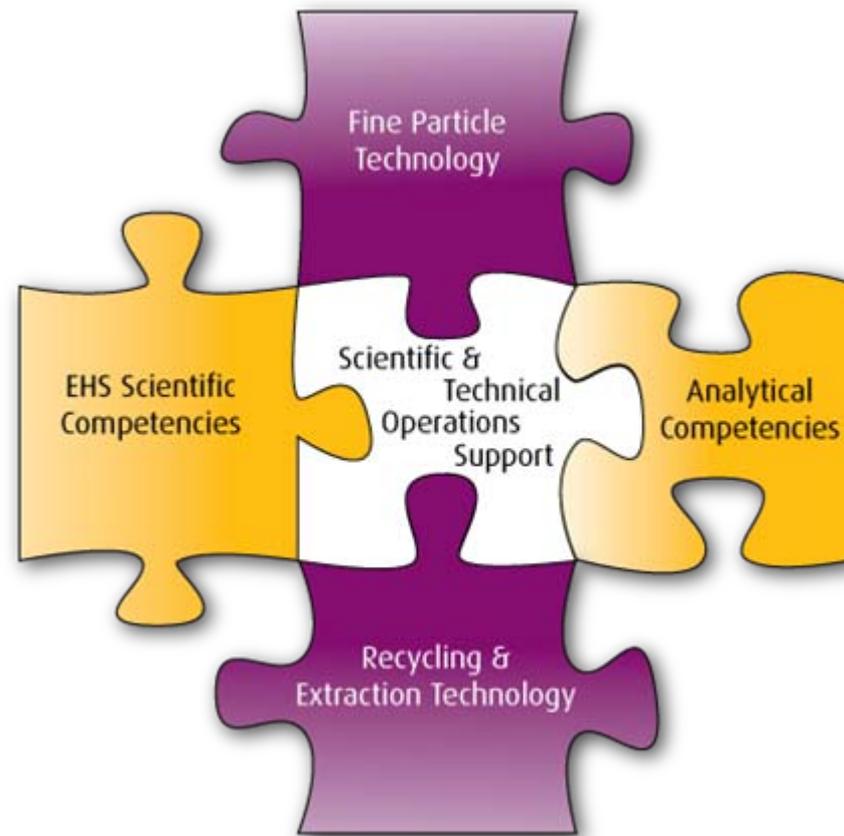
R&D is the tool kit of the company

- Essential to answer to the needs of our customers
- Coherence and cross-fertilization between the different segments
- Focus on sustainability
- Makes us ready for trend changes in society

Group R&D provides R&D services to business units and CTO projects

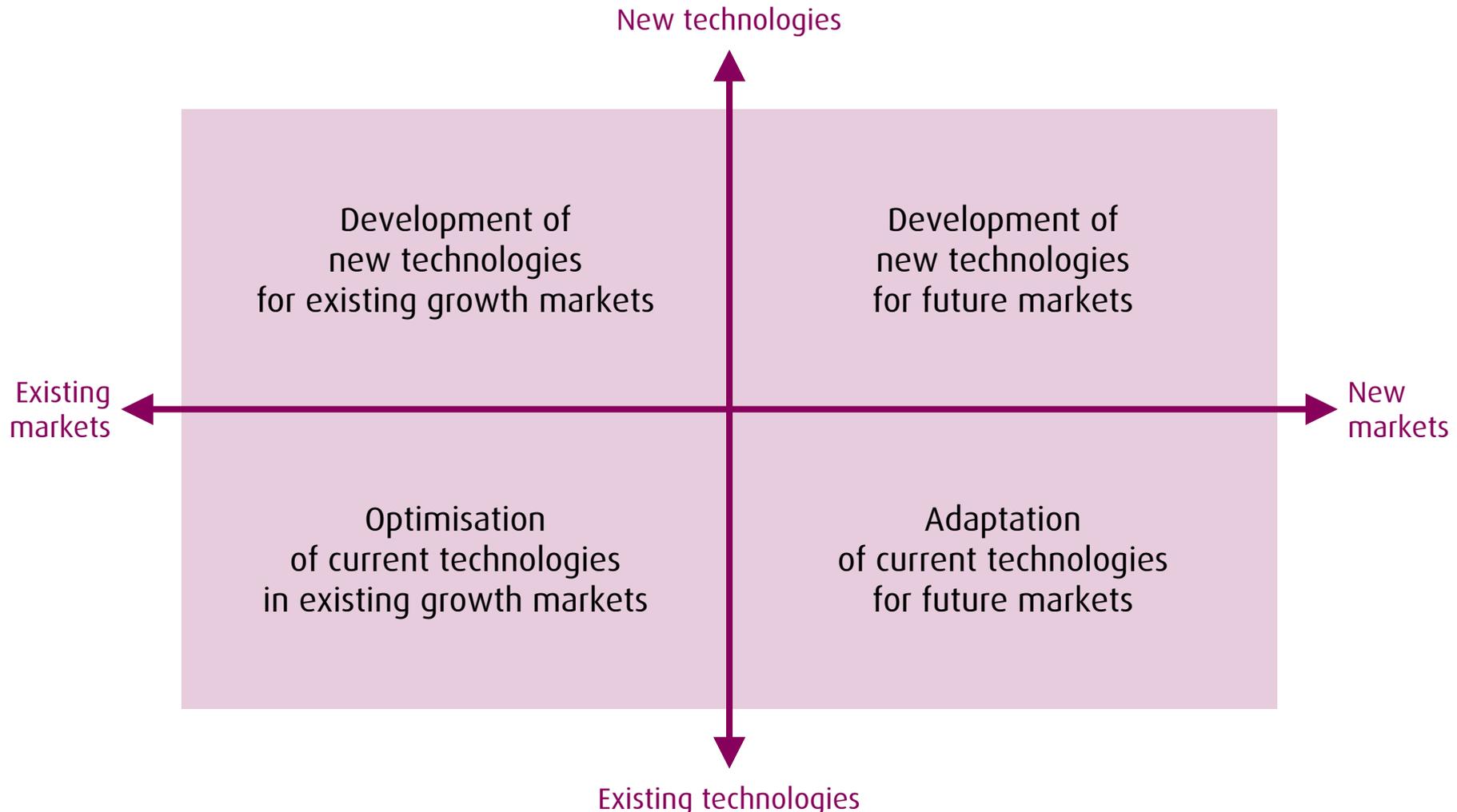


Research & development Organised in technological competence platforms



R&D technology portfolio

Technology portfolio based on adjacencies



Technology portfolio horizon



Umicore typically covers a 1 to 15 year horizon

Development in line with market introduction and supply chain requirements

Focus is different depending on time horizon

- IP creation
- Joint Developments
- Applied Technology
- ...

Arbitrage is necessary to keep a balanced portfolio



How do the R&D
platforms serve
Recycling?



Competence platform Recycling & Extraction Technology

EMC project

New pre-concentration step of PMR

Improvement of metallurgical processes and emission gas cleaning leading to:

- Reduction of
 - Lead times for precious metals
 - Emissions of dust, SO₂ and NO_x
 - Direct costs
- Increase of metal yields and operational flexibility





Competence platform Recycling & Extraction Technology

UHT pilot setup for new waste streams
"Ultra High Temperature"

Innovation in smelting technology by design and development of:

- High density energy sources
- Heat resistant furnace technology
- Environmental top performance technology





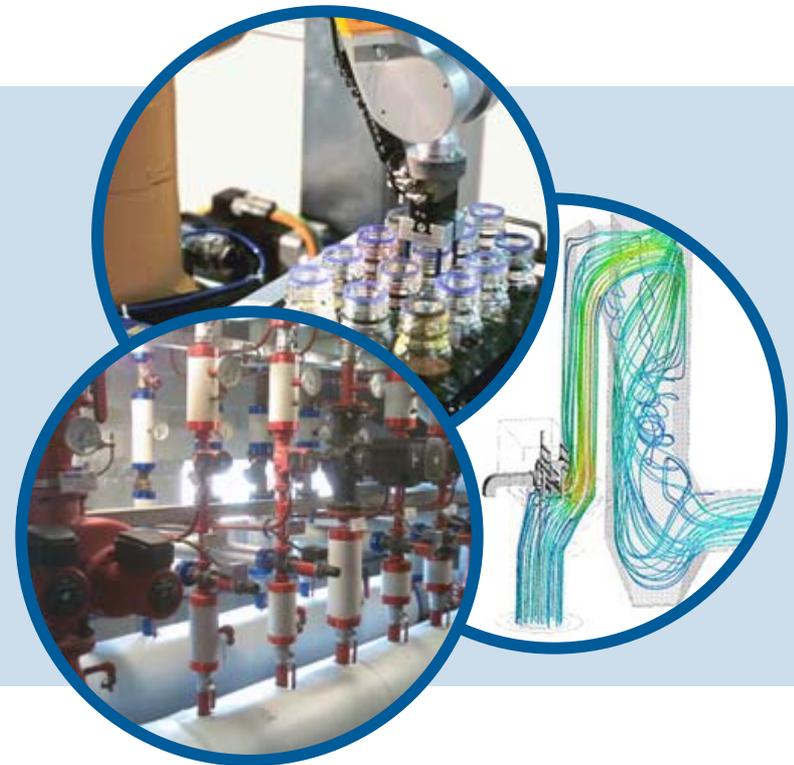
Competence platform Scientific & Technical Operations Support

Detailed flow sheet modelling of EMC project

Simulation gas streams in Cu-smelter leading to improvements in design to reduce puffing

- Lower lead emissions
- Increase of loading capacities

Technology Scouting - Scientific Relations -
Intellectual Property - External funding





Competence platform Environment, Health & Safety (EHS)

**Nano-filtration on industrial waste waters by
membrane technology in PMR**

Screening of different membranes and pilot unit
testing to:

- Comply with more stringent discharge limits
- Reduce water footprint with 40%
- Recover chemicals





Competence platform Environment, Health & Safety (EHS)

Product life cycle analysis: Toyota Prius Battery

Pursuing greater sustainability in automotive supply chain

Objectives:

- Investigation of impact environmental footprint Ni
- Identification of key environmental parameters in production, use and end of life

Recycling advantages:

- Reduction of global warming and acidification potential
- Resource conservation of Ni, Co and Cu





Competence platform Analytical Competencies

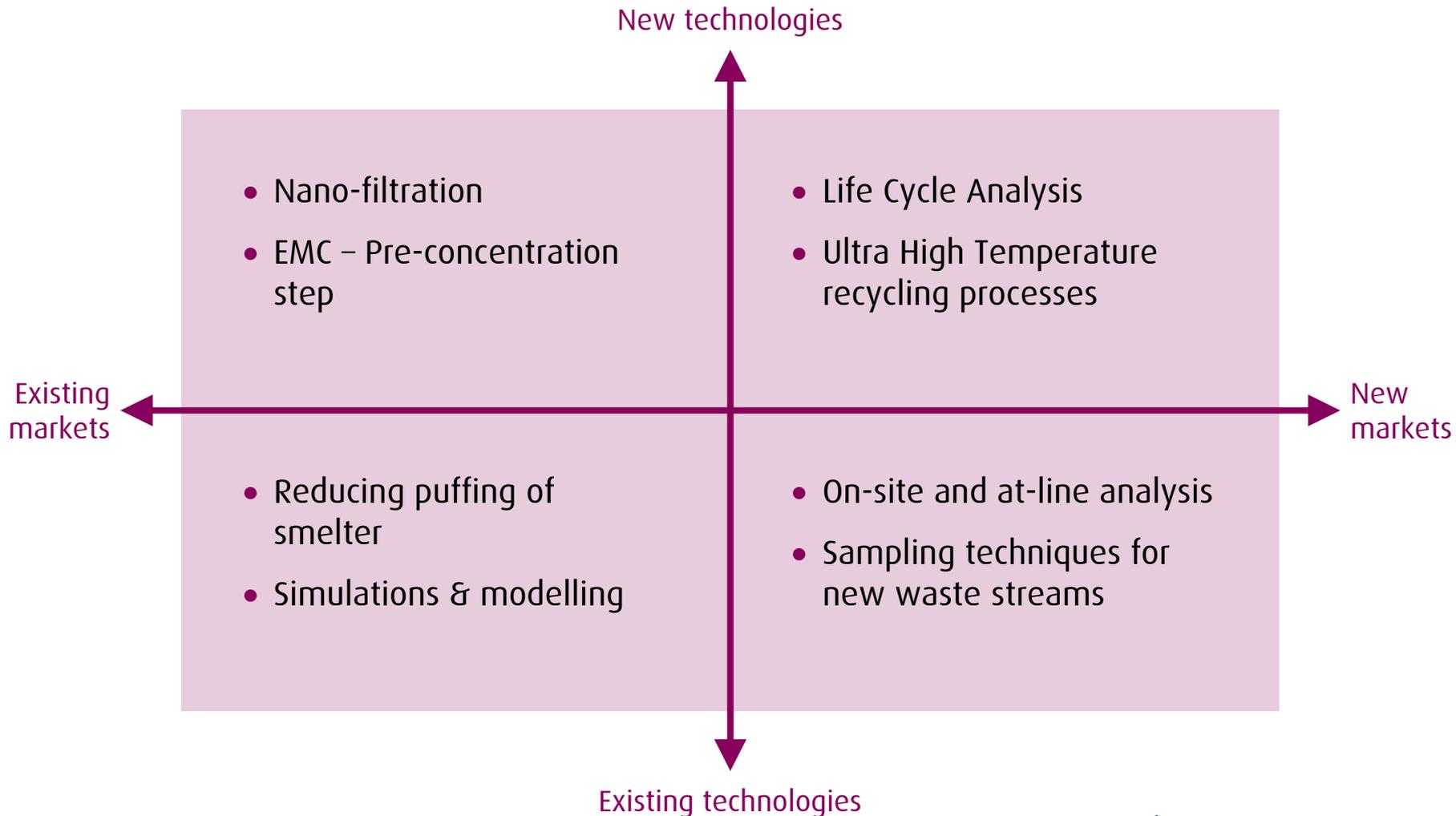
Development of new sampling processes to handle new supply streams like auto and spent cats, E-scrap, batteries etc....

Development on-site & at-line analysis methods with hand held equipment for fast screenings

- On site X-ray measurements of slags to determine metal content to decide on further refining
- Raw materials check at input for 1st indication of metal content e.g. autocat contents of Pt, Pd & Rh



A balanced R&D portfolio: Examples in recycling



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Denis Goffaux Chief Technology Officer



Denis Goffaux graduated from the University of Liège in 1991 as a mining engineer and joined Umicore Research in 1995. He has worked in Belgium, Chile, China and Korea. Prior to moving to Japan to become Umicore Country Manager in 2006, he headed the Rechargeable Battery Materials business line.