

Closing the loop for technology metals

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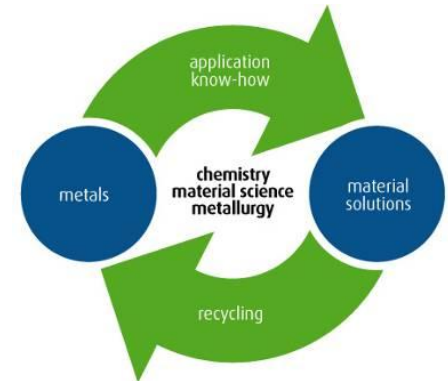
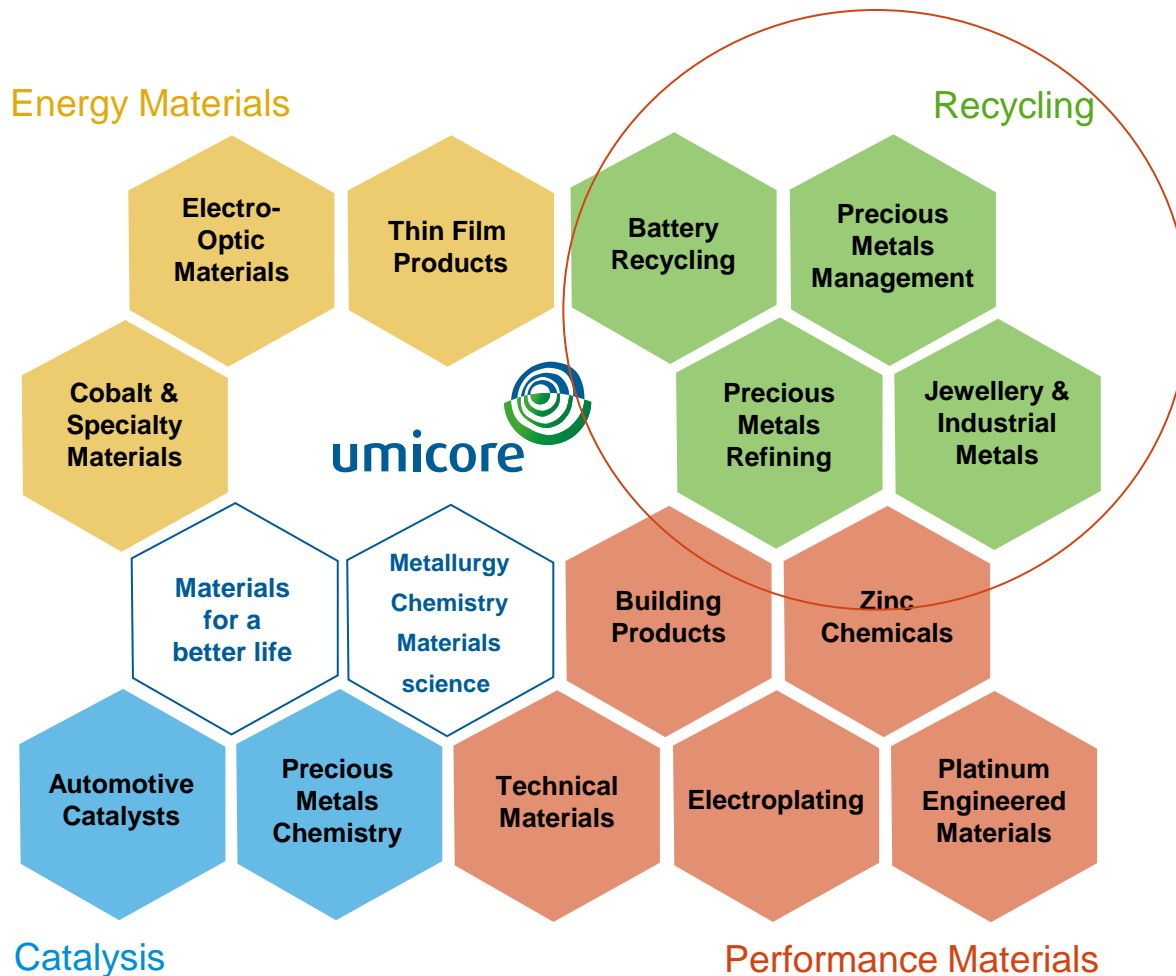
Green Alliance & CBI

Building resilience: Resource security and the role of the circular economy

London, December 12, 2011

Umicore – a materials technology company

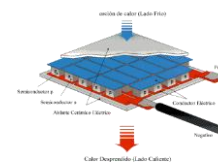
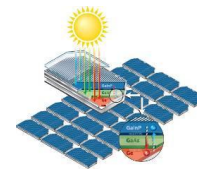
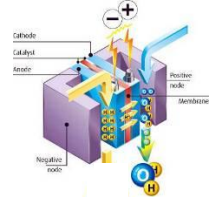
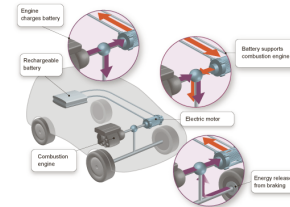
strategic recycling approach to secure metals supply



- Focus on clean technology
- 14.500 employees
- 10 Bn. € turnover
- 70 industrial locations globally
- Ø 50% of metal needs from recycling

Competing use of technology metals in many emerging applications/Umicore products

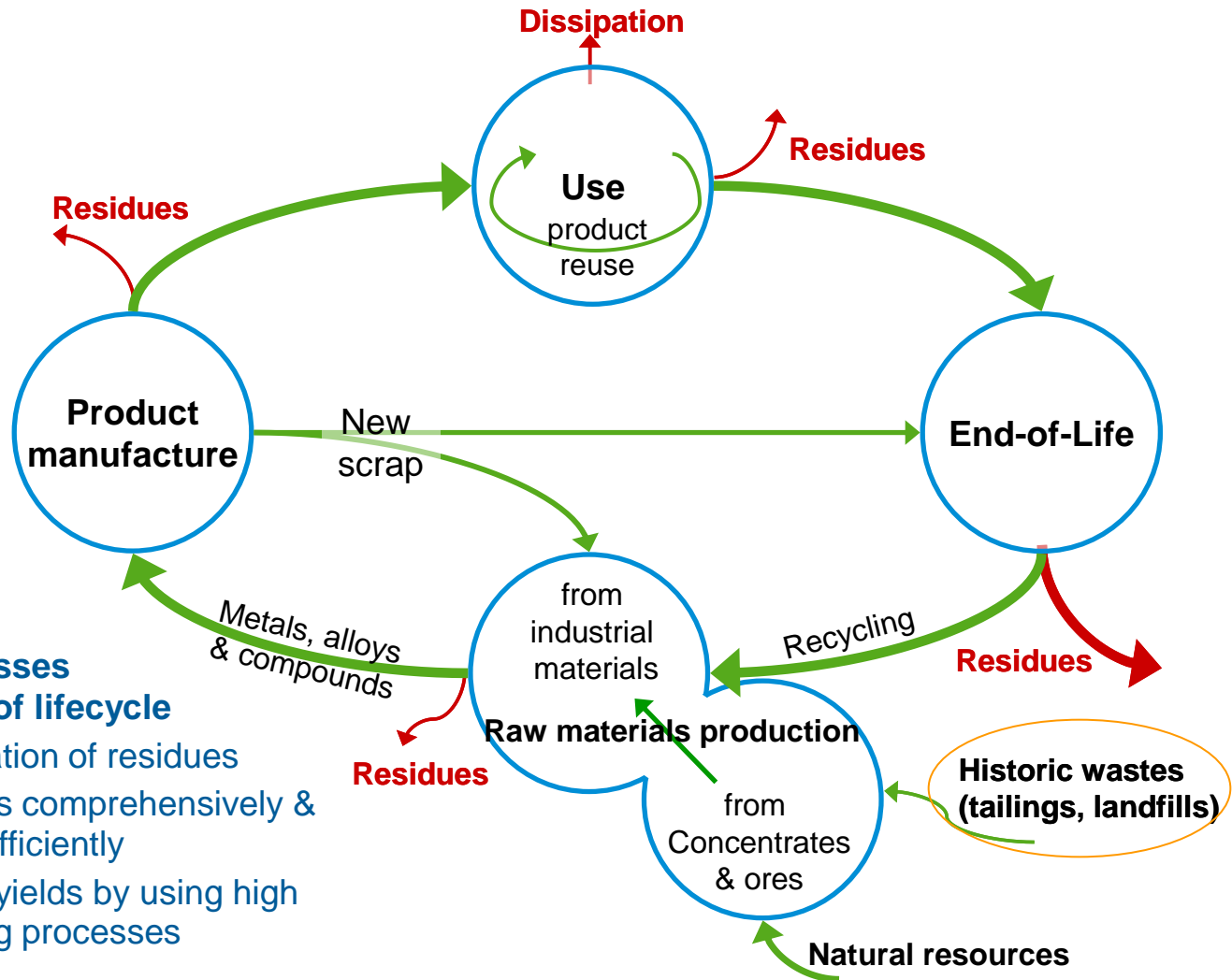
- **Electric vehicles & batteries**
cobalt, lithium, rare earth elements (REE), copper
- **Emission catalysts & fuel cells**
platinum, palladium, rhodium, gold, ruthenium, REE
- **Photovoltaic (solar cells)**
silicon, silver, indium, gallium, selenium, tellurium, germanium
- **Thermo-electrics, opto-electronics, LEDs, IT...**
bismuth, tellurium, silicon, indium, gallium, arsenic, selenium, germanium, antimony, REE, ...



- ➔ Umicore focus on availability & recycling of technology metals
- ➔ many of those also among the „EU critical 14“

Vision: the circular economy

mining and recycling as complimentary systems



⇒ **reduce metal losses along all steps of lifecycle**

- Reduce generation of residues
- Collect residues comprehensively & recycle these efficiently
- Improve metal yields by using high quality recycling processes

The opportunity: Mining our high tech waste

Example: Metal use in electronics

Global sales 2010

a) Mobile phones

1600 million units/ year

X 250 mg Ag	≈	400 t Ag
X 24 mg Au	≈	38 t Au
X 9 mg Pd	≈	14 t Pd
X 9 g Cu	≈	14,000 t Cu

1300 million Li-Ion batteries

X 3.8 g Co	≈	6100 tCo
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b) PCs & laptops

350 Million units/year

X 1000 mg Ag	≈	350 t Ag
X 220 mg Au	≈	77 t Au
X 80 mg Pd	≈	28 t Pd
X ~500 g Cu	≈	~175,000 t Cu

~180 million Li-ion batteries

X 65 g Co	≈	11,700 tCo
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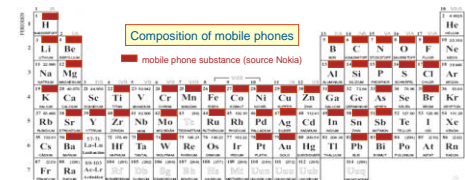
a+b) Urban mine

Mine production / share

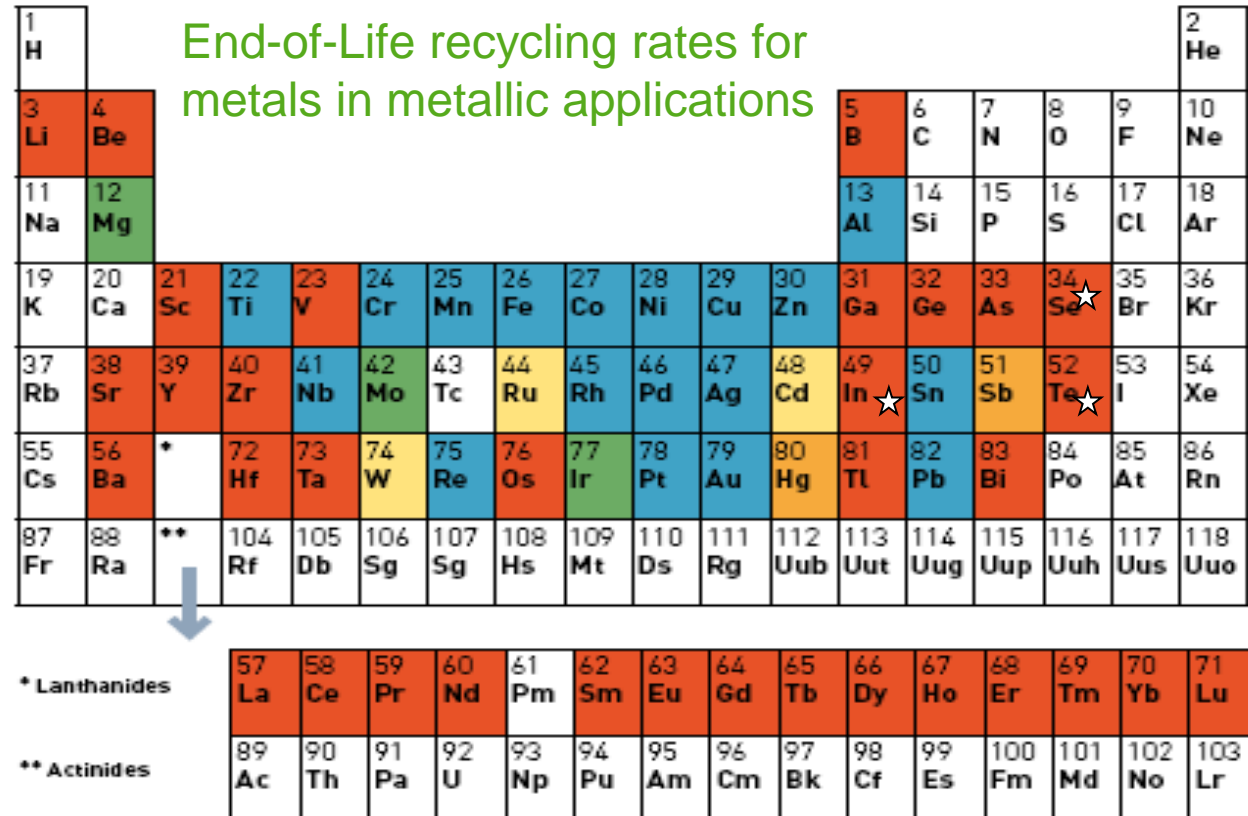
Ag:	21,000 t/a	▶	4%
Au:	2,500 t/a	▶	4%
Pd:	220 t/a	▶	19%
Cu:	18 Mt/a	▶	<1%
Co:	75,000 t/a	▶	23%



- Cumulated global sales of mobile phones until 2010: 10 Billion devices
- Other electronic devices, cars etc. add even more to these figures
- Containing many other technology metals → significant total demand
- Intrinsic value per mobile phone ~ 1 € ⇒ little economic recycling incentive per unit, but volume counts!



The challenge: so far low recycling effectiveness for many technology metals

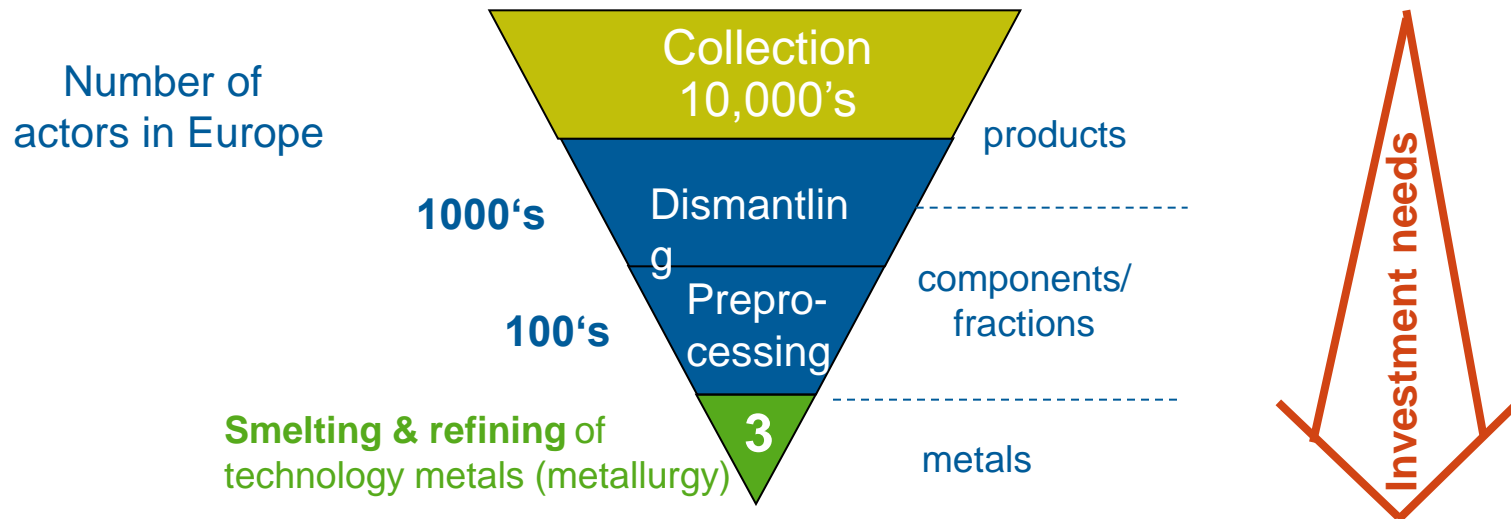


Source: UNEP (2011) Recycling Rates of Metals – A Status Report, A Report of the Working Group on the Global Flows to the International Resource Panel- Graedel, T.E.; Alwood, J.; Birat, J.-P.; Buchert, M.; Hagelüken, C.; Reck, B.K.; Sibley, S.F.; Sonnemann, C.

Recycling needs a chain, not a single process

- system approach is crucial

Example recycling of WEEE Recovery of technology metals from circuit boards



Total efficiency is determined by weakest step in the chain
Make sure that critical fractions reach these plants

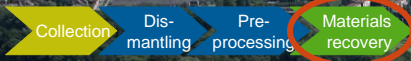
Example: 30% x 90% x 60% x 95% = 15%

Recycling of technology metals

➔ Hi-Tech & Economies of Scale are crucial for success



Umicore's integrated smelter-refinery in Hoboken/Antwerp



ISO 14001 & 9001, OHSAS 18001

- Input > 300 000 t/a PM-bearing secondary materials (WEEE, catalysts, smelter by-products etc.), global customer base, final waste < 5% of feed
- Recovery of 17 metals: Au, Ag, Pt, Pd, Rh, Ru, Ir, Cu, Pb, Ni, Sn, Bi, Se, Te, Sb, As, In (universal process).
- Innovative special processes for more metals: rechargeable batteries → Co, (Li, REE); CIGS-PV residues → Ga
- Investments since 1997: 500 M €; Invest. for comparable green field plant: >> 1 Bn €!
- PM yields >> 95%; value of precious metals enables co-recovery of specialty metals ('paying metals')

Main flaws in European recycling

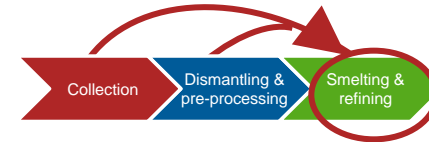
- relevant fractions don't reach best suited processes

a) Poor collection



b) "Deviation" of collected products

⇒ dubious exports ⇒ backyard treatment



c) Inappropriate intra-EU sorting & pre-processing

⇒ high losses of technology metals





What needs to be done ?

1. Collect more & better
 - ⇒ ambitious targets, own category for small ITC, business models (e.g. deposit on mobile phones, campaigning, labels, public procurement ...)
2. Prevent dubious/illegal exports
 - ⇒ monitoring, close loophole, certification of recycling chains, stringent controls, severe penalties, ...
3. Ensure smart recycling
 - ⇒ quality more important than quantity (plant certification, transparency of flows, ...)
 - ⇒ holistic optimisation of recycling chain, focus on interface management & product design
4. Develop innovative processes for difficult material mixes (REE, Li, In, Ga,..)
 - ⇒ R&D funding, European cooperation (RMI; planned EU Innovation Partnership on RM)
5. Improve data basis
 - ⇒ composition, „stocks & flows“ of secondary raw materials
6. Create legislative support for recycling of technology metals
 - ⇒ adapt waste directives (e.g. current WEEE recast); create incentives for recycling of critical metals
7. Enhance (university) education (interdisciplinary approach beyond engineering)

**Consequently enhance recycling opportunities.
Install “policy guardrails” to secure high quality recycling along the entire chain.
Connect and align national activities with EU initiatives and policy**

Thank you!



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