Electrified Recovery and Upcycling of Strategic and Critical Raw Materials

MateriNex – Strategic and Critical Raw Materials Session

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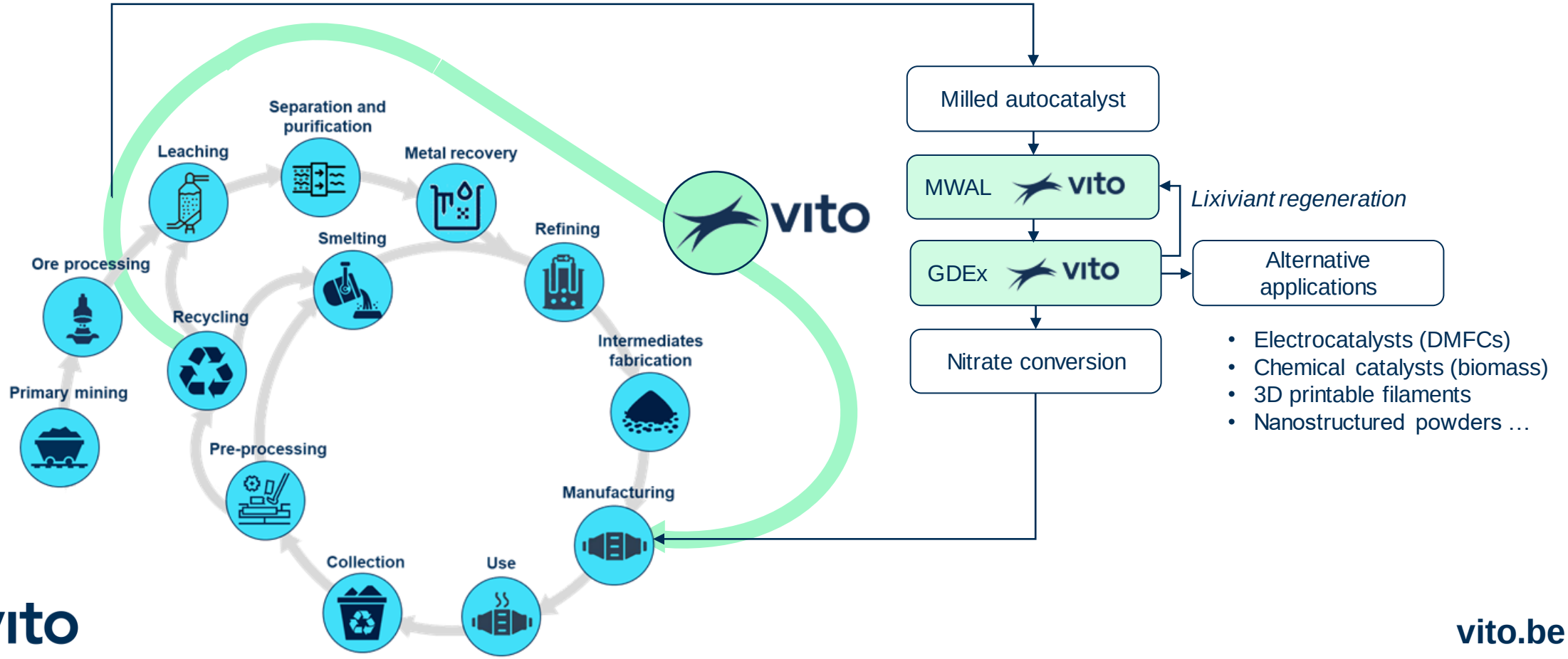
What can we do for companies?

Future developments based on our past success

VITO developed a new and fully electrified recovery and upcycling chain for PGMs from automotive catalytic converters, from TRL-3 (experimental proof of concept) to TRL-7 (pilot balance of plant, demonstrated in operational environment).



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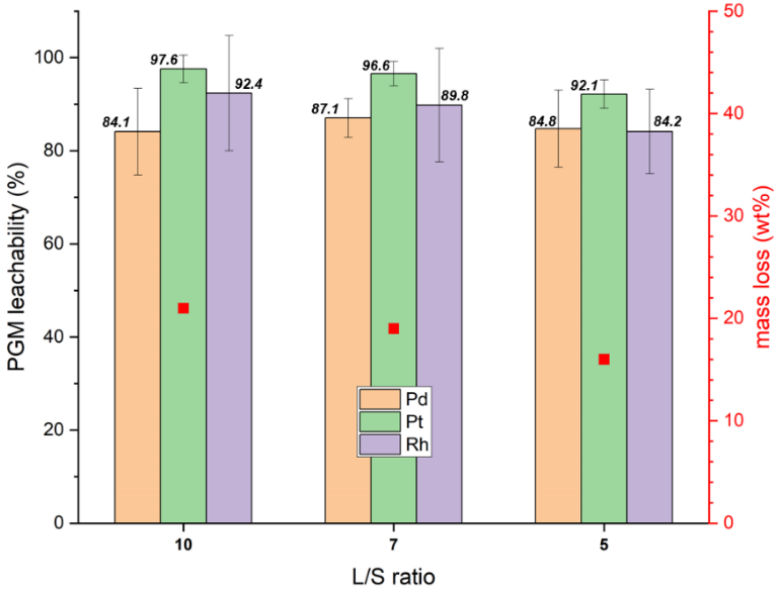
MWAL vito

No oxidation agent
Process optimization

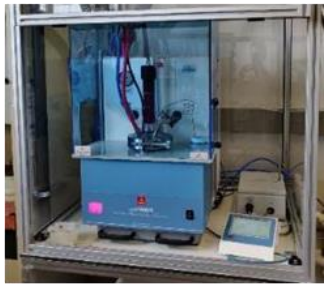


FlexiWave

3 g per experiment

Up-scaling

SynthWave

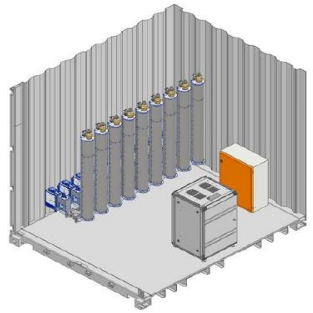


50 g per experiment

Up-scaling

vito ceinnmat Emerging technologies

Pilot scale installation



5-10 kg per hour

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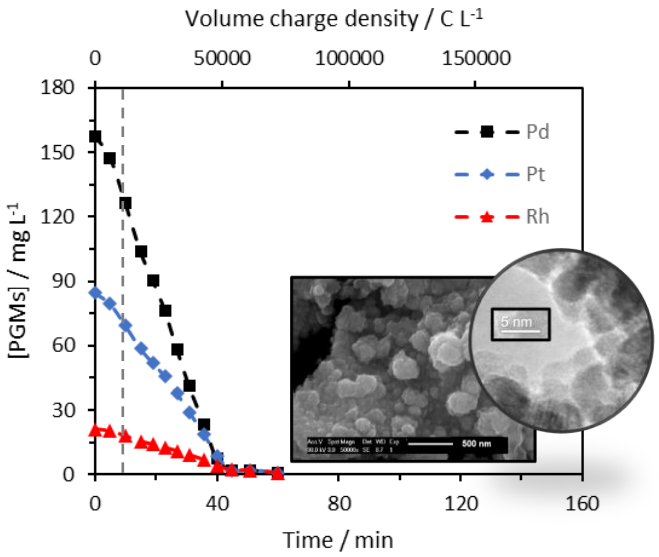
GDEx vito

CO_2 only chemical input
Process optimization



Pd	Pt	Rh	Al	As	Ba	Ca	Ce	Co	Cr	Cu	Fe	La	Mg	Mn	Mo	Nd	Ni	Pb	Sr	Ti	Zn	Si

NPs compositional mapping (EDX)

Element	Content %		
	j / mA cm^{-2}		
	-10	-40	-200
Pd	57	53	64
Pt	18	17	20
Rh	9	8	8
Cu	7	5	4
Pb	6	5	3
Al	1	3	0.3
PGMs	**84**	**78**	**92**

Application *DMFCs : Performance comparable to commercial materials*

Up-scaling

Recyclability of the GDEx effluent (spent leachate) is possible, with similar PGM extraction yields in the MWAL process and subsequent GDEx recovery/upcycling.

100 L/h from MWAL
2 kg PGMs mix per week

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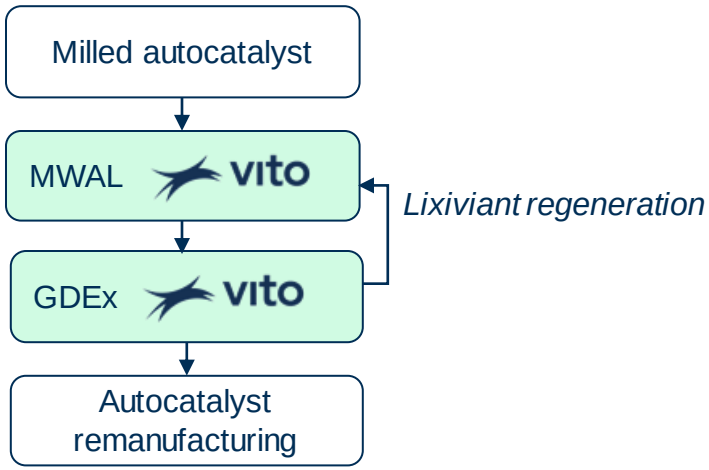
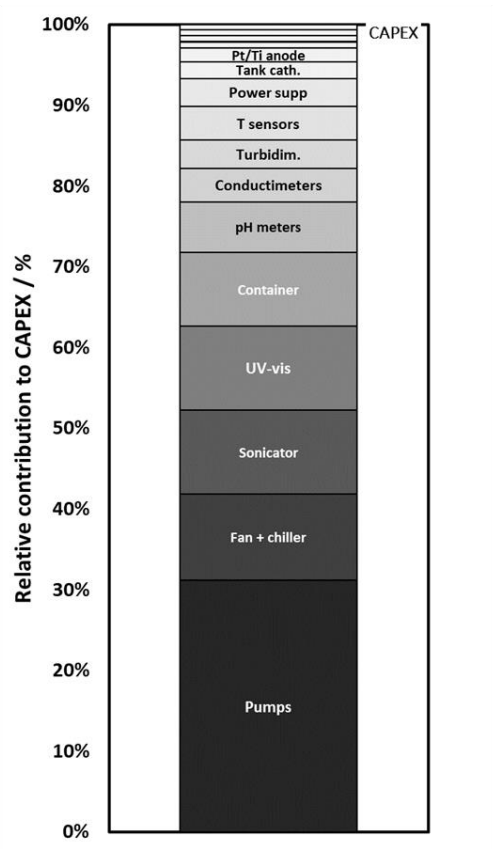
Input feed: catalytic converters



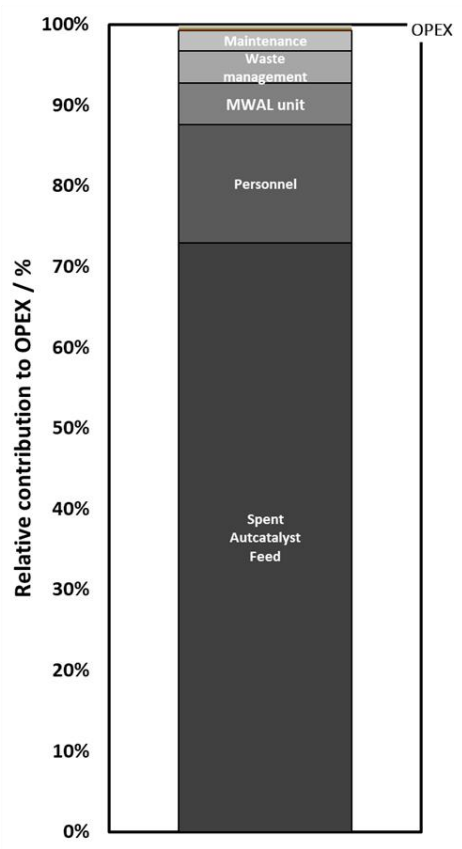
Output:

Elemental PGM mix 1730 t/y

CAPEX:
520 k€ (0.3 k€ / kg PGM mix)



OPEX:
3820 k€ (23 k€ / kg PGM mix)



Profit margin
37%

NPV
7.7 M€ (10y horizon)

ROI
> 1000%

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Future possibilities

- **We will develop and optimize (performance, sustainability, costs) electrified recovery and upcycling chains:**

  - PGMs (new applications, *e.g.*, chemical catalysts, new semiconductors, medical devices, etc.)
  - Lithium recovery (geothermal brines, ores, off specs. cathode materials, etc.)
  - Battery recycling (graphite, active cathode materials like NMC or LFP, etc.)
  - Other S&CRMs….

Collaborations sought for these topics within MateriNex with VITO as coordinator

SBO (TRL 3-5) & ICON (TRL 4-7) proposals (there are challenges at different TRL levels)

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