

P&P Industries AG

State-of-the-art sulphuric acid making
- platinum promoted honeycomb
ceramics on the way to opex and
capex reduction

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P&P Industries AG

Who we are
P&P History

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Industry Sectors

Oil & Gas, Fertilizer Industry
Power Plant, Metallurgical-, Viscose Industry

03

P&P Process

Sulphuric Acid Process

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Excerpt of P&P proprietary equipment

Platinum Catalyst



Who are we

Medium-sized, internationally operating company

- HQ next to Graz, subsidiary in IND, GER, CZE, ITA
- 6 locations on 2 continents, > 200 employees
- Our team consist of highly trained professionals:

Process Engineering,

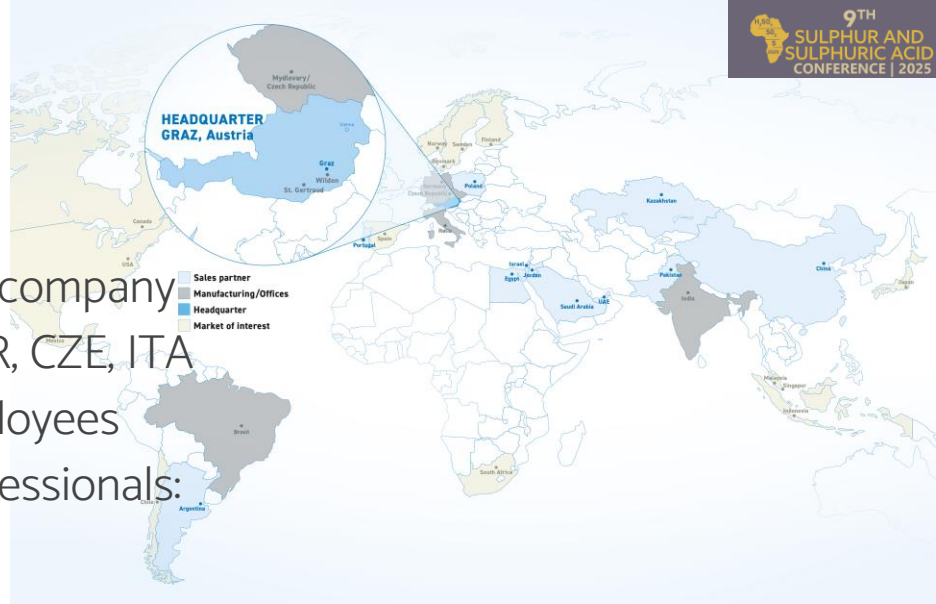
Mechanical Engineering

Electrical & Instrument Engineering, hard & software solutions

Research & Development

- We offer on site installation, start-up and training

We provide technology (PFD, Basic-, Detail Engineering), proprietary equipment, site supervision and we can be your EPC Contractor



P&P History

2006 P&P Industrietechnik GmbH

2006 Laboratory "Stocking" opened

2010 1st SOP with 48 MTPD 96 w%

2011 H₂SO₄, as well as 1st start up

2012 Cooperation with Voest
Alpine Grobblech for STO₂
automation

2014 SOP 504 MTPD 98 w%
H₂SO₄ successful hand over

2015 P&P Industrietechnik GmbH
merges with
P&P Anlagentechnik GmbH

2015 1st successful Start up of P&P
SAR double stage plant
(H₂S as fuel gas)

2016 Joint Venture between P&P
and Harbin BOAO, China

2016 14 Chinese Sulfuric Acid Plants,
2018 engineering in parallel

2019 P&P Industrietechnik GmbH
renamed to P&P Industries AG

2020 AGRU Award for PVDF applications

2020 Add. Workshop in „St. Gertraud“

2020 Market start of latest PT-Catalyst
types

2024 DeNOx+ for > 99 % reduction using
P&P PrimePurity Catalyst



Industry Sectors

Oil & Gas

P&P Process

- **Onsite recycling:** Spent Acid Regeneration (SAR) for alkylation units > closed loop, low OPEX, ultra low emission
- **Direct Sulphuric Acid Production:** SRU replacement / tail gas treatment, direct conversion of sulphur components to sulphuric acid > reduced CO₂ footprint, increased steam production, low cost sulfuric acid
- **From flare to product:** Flare gas recovery, removal of sulfur components from flare gas > valuable product

Fertilizer Industry

- **State of the art gas cleaning:** with WESP technology for dust removal, absorption trays technology for ammonia removal
- **Sulphur Oxidation Plant (SOP):** producing sulphuric acid used to make phosphoric acid, to make the phosphate fertilizers, calcium dihydrogen phosphate and the ammonium phosphates



Industry Sectors

Power Plant

Mining & Metallurgy

Viscose Industry

P&P Process

- **From waste to value:** gas cleaning and converting SO_2 to sulphuric acid > replacement of gypsum handling
- **Selective catalytic reduction:** removing of NO_x from waste gas > ultra low emission
- **Onsite recycling:** Spent Acid Regeneration (SAR) in metal extraction / leaching process > closed loop, low OPEX, ultra low emission
- **Direct Sulphuric Acid Production:** after off gas cleaning from smelter direct conversion of SO_2 to sulphuric acid > sulphuric acid & steam for further process, ultra low emission
- **Platinum honeycomb catalyst for SO_2 oxidation:** Revamp in “Dry-” and “Wet Sulfuric Acid Process” > increase of production, low OPEX, ultra low emission
- **From waste to value:** direct conversion of sulphur components to sulphuric acid > from tail gas treatment to valuable product



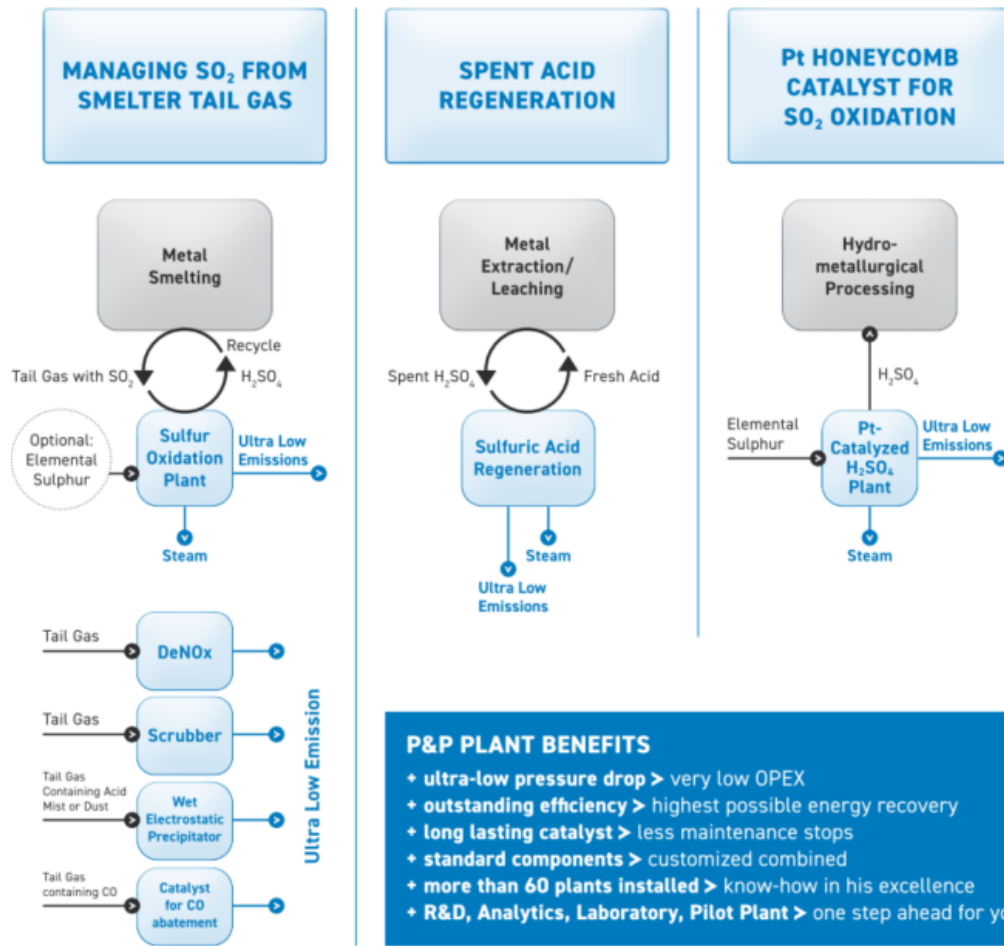
03



SULFURIC ACID TECHNOLOGY

Make - consume - recycle - reuse:
the perfect cycle for sulfuric acid.

Metallurgical Industry



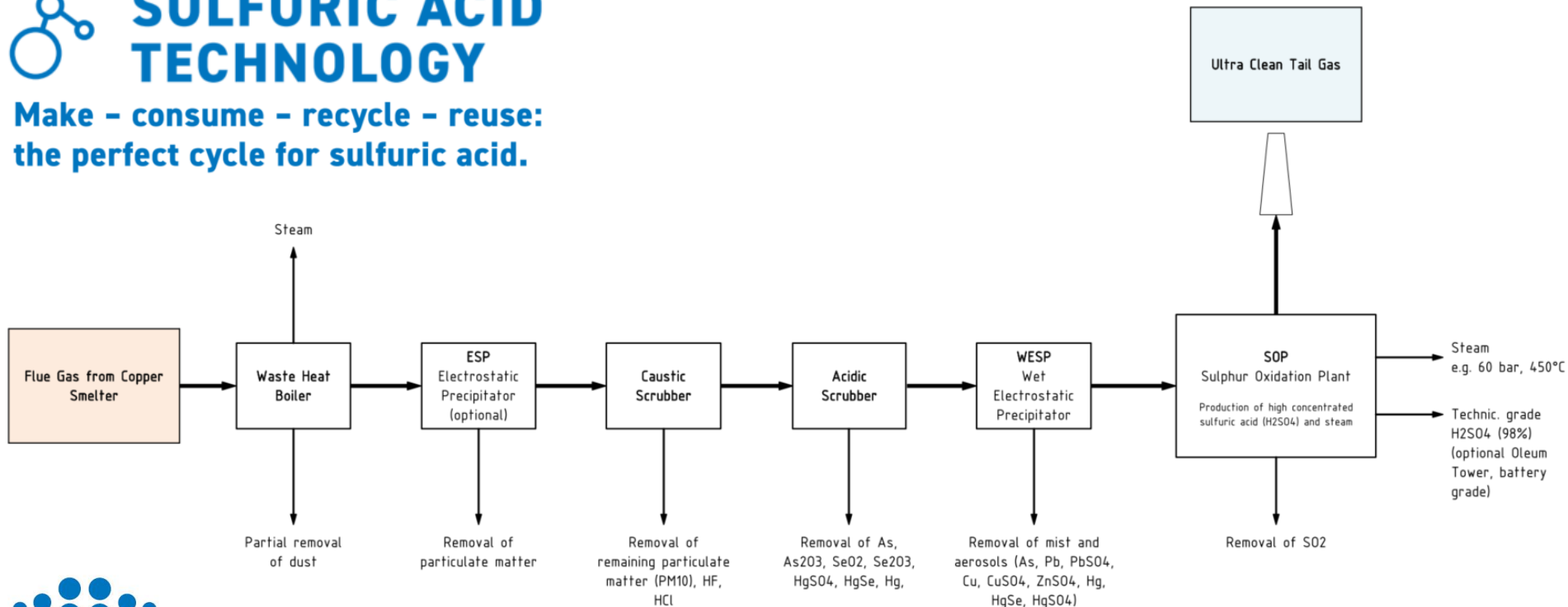
P&P PLANT BENEFITS

- + **ultra-low pressure drop** > very low OPEX
- + **outstanding efficiency** > highest possible energy recovery
- + **long lasting catalyst** > less maintenance stops
- + **standard components** > customized combined
- + **more than 60 plants installed** > know-how in his excellence
- + **R&D, Analytics, Laboratory, Pilot Plant** > one step ahead for your benefits



SULFURIC ACID TECHNOLOGY

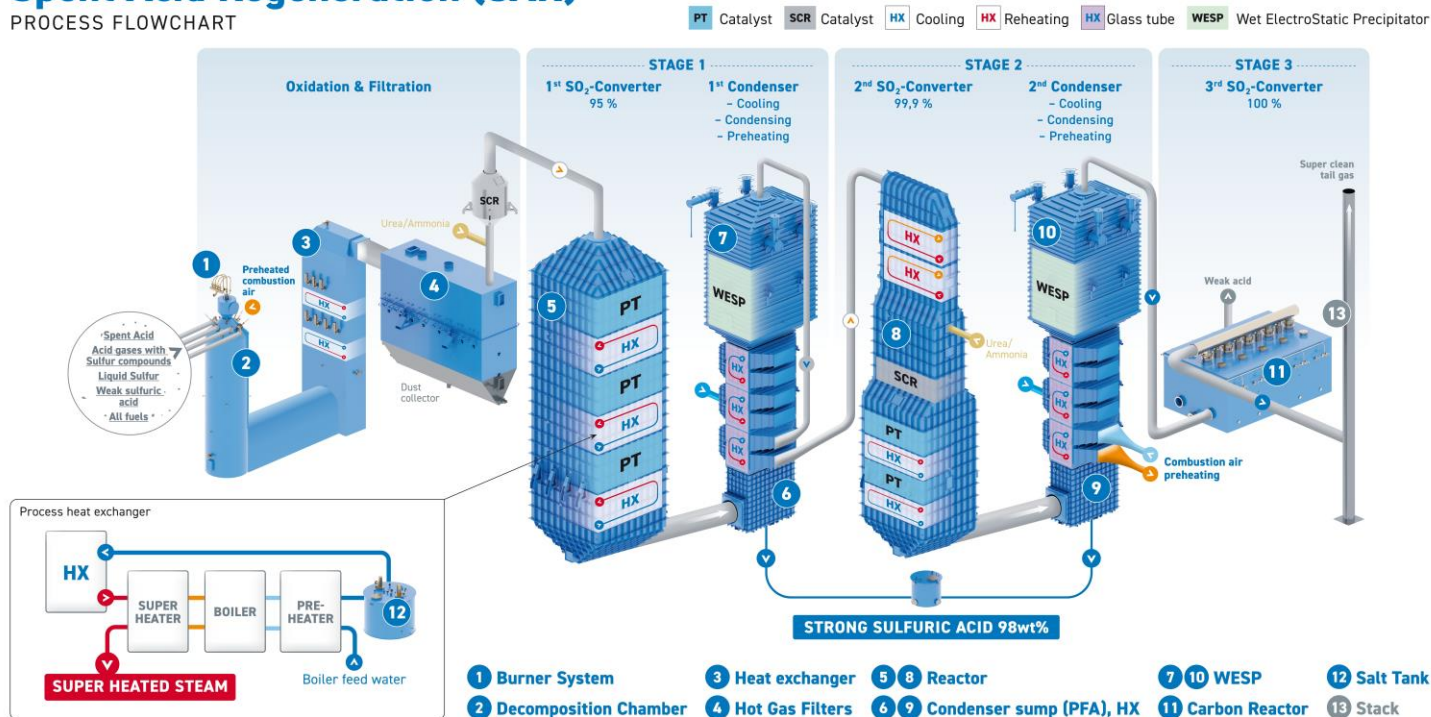
**Make – consume – recycle – reuse:
the perfect cycle for sulfuric acid.**



Sulfuric Acid Process

Spent Acid Regeneration (SAR)

PROCESS FLOWCHART



Patented sulphuric acid production process / Patent Nr.: 3792220



SULFURIC ACID TECHNOLOGY

Summary of P&P Plant Advantages:

1. **Low OPEX:** Ultra-low pressure drop
2. **High steam yield:** 1 ton of acid generates up to 1.5 tons of steam.
3. **Platinum Catalyst (VividOx®):**
 - Long lifespan (up to 10 years).
 - Fully recyclable, with up to 75% of platinum value recoverable.
 - No screening, disposal, or carcinogenic risks.
4. **Ultra-low emissions:** <50 ppm SO₂.
5. **Versatility:** Treat spent acid with a small setup, reducing raw material usage, increasing profitability, and improving your environmental footprint.
6. **Flexibility:** The equipment can handle various gases (S, H₂S, CS₂), making it adaptable for multi-use operations.



References & Industries



33

successfully installed
large-scale plants
in the sulfuric acid
industry.

7

successfully installed
scrubber systems
in the waste gas
treatment.

27

successfully
installed DeNOx plants
in the waste gas
treatment.

45

successfully installed
wet electrostatic precipitators
in the waste gas treatment and
the sulfuric acid industry.

100+

total plant
installations.
Station 2023

... and many
more current
projects!

References

Further detailed references are shown on our homepage

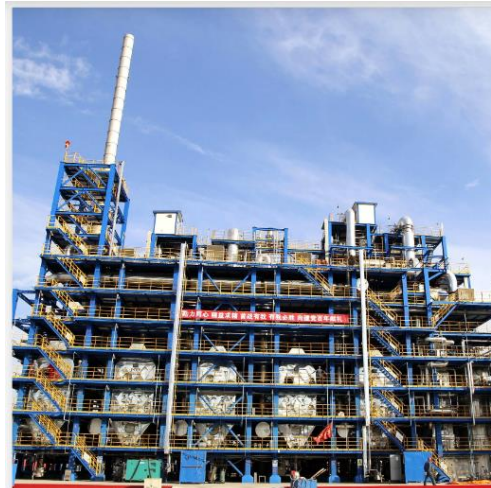
<https://www.pp-industries.at/>



Spent Acid Regeneration

Industry:	Petrochemical
Application:	S.A. Production
Catalyst:	P&P's Proprietary VividOx
Date Installed:	2019, Running
Production:	90 MTPD, 98wt% SA

📍 China



Spent Acid Regeneration

Industry:	Petrochemical
Application:	acid gas (H ₂ S), Spent H ₂ SO ₄ , liquid Sulfur
Catalyst:	P&P's Pt Catalyst
Date Installed:	2019, Running
Production:	72 MTPD, 98wt% SA

📍 China



Sulfur Oxidation Plant

Industry:	Petrochemical
Application:	acid gas (H ₂ S), Spent H ₂ SO ₄ , liquid Sulfur
Catalyst:	P&P's Pt Catalyst
Date Installed:	2012, Running
Production:	504 MTPD, 98wt% SA

📍 China





PRECIOUS METAL CATALYSTS



Advantages of P&Ps catalyst technology

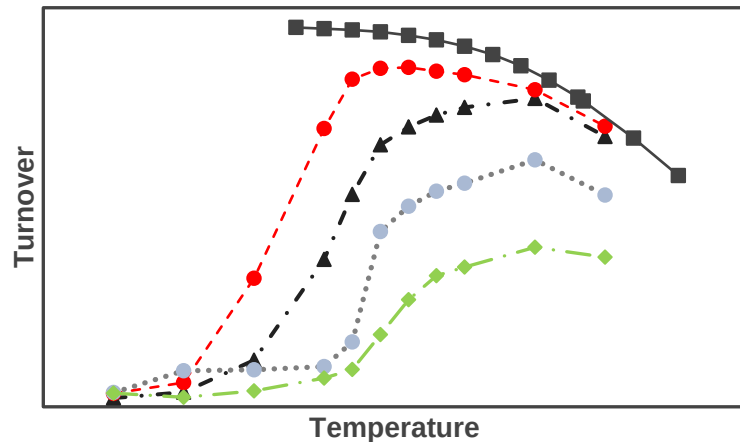
Total Oxidation Catalyst – Potential
Oxidizable Compounds in Feed Gas

- SO_2 -Oxidation
- H_2S , CS_2 and COS -Oxidation
- C_xH_y , $\text{C}_x\text{H}_y\text{Cl}_z$ & CO -Oxidation
- Selective Catalytic Oxidation (SCO) for Ammonia Slip after SCR-hurdles

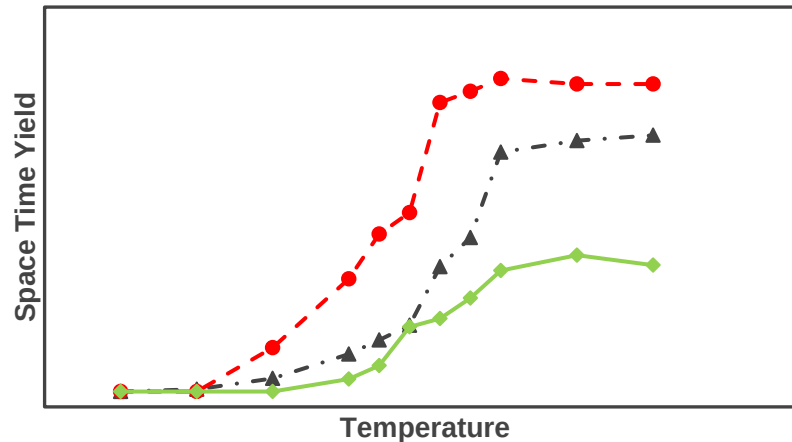




PRECIOUS METAL CATALYSTS



- ▲— Pt promoted Honeycomb 1 - lower doped
- - -●- Pt promoted Honeycomb 2 - highly doped
- VO bulk catalyst 1
- ◆— VO bulk catalyst 2



- ▲— Pt promoted Honeycomb 1 - lower doped
- - -●- Pt promoted Honeycomb 2 - highly doped
- ◆— VO bulk catalyst 2

- Ignition at lower temperatures
- Higher activity
- Increased space time yield



**Increased performance at
reduced catalyst demand**



PRECIOUS METAL CATALYSTS

Competing Technologies – V_2O_5
Bulk Catalyst

P&P's Platinum Based Catalysts

Pressure Drop

See Next Slides

Surface Area

$1-2 \times 10^6 \text{ m}^2/\text{m}^3$

$5 \times 10^6 \text{ m}^2/\text{m}^3$

Screening

5-20% of Volume lost per year

None

Bulk Density

450 kg/m^3

800 kg/m^3

Toxicity

Carcinogenic

None, dust protection

Service Life

5-10 Years

>10 Years

Hardness

Cutting: 70-110N

Vickers: $\approx 25 \text{ GPa}$

Mohs: 9+

Attrition

1-2%

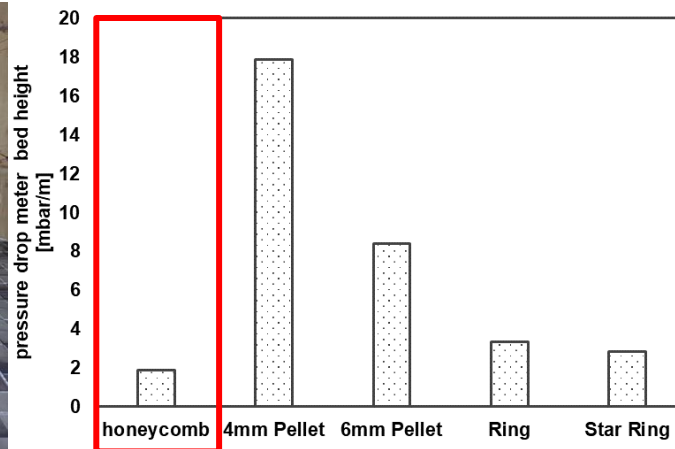
0.05%





PRECIOUS METAL CATALYSTS

Reactor size and pressure drop reduction



- Reactor size can be lowered by a factor of three!
 - Lower volumes for catalyst beds sufficient.
 - Smaller reactors possible for same production capacity.
- CAPEX reduction

- Pressure Drop can be drastically reduced
 - lower catalyst bed heights for pressure drop reduction beneficial
- OPEX reduction

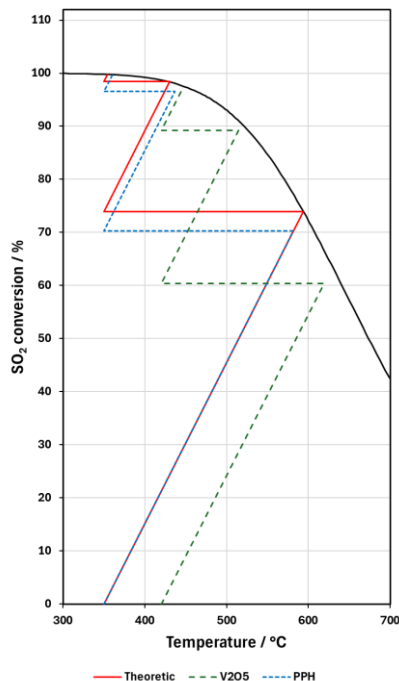




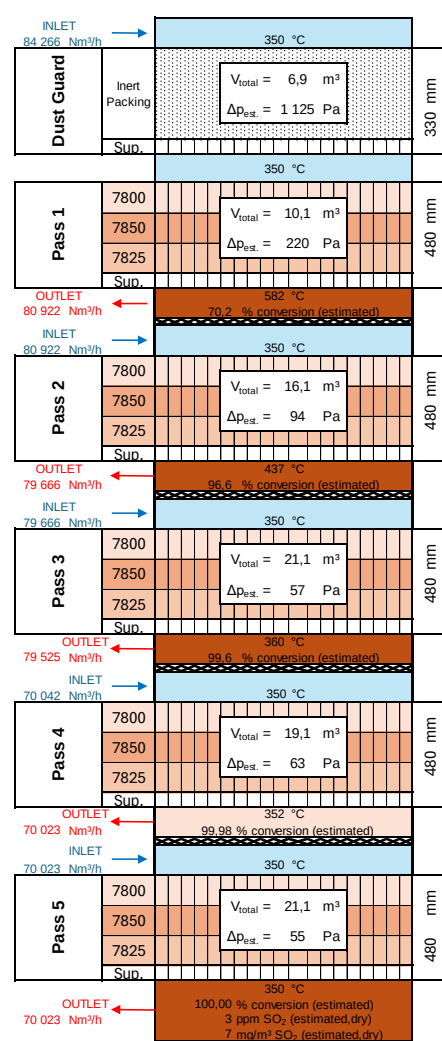
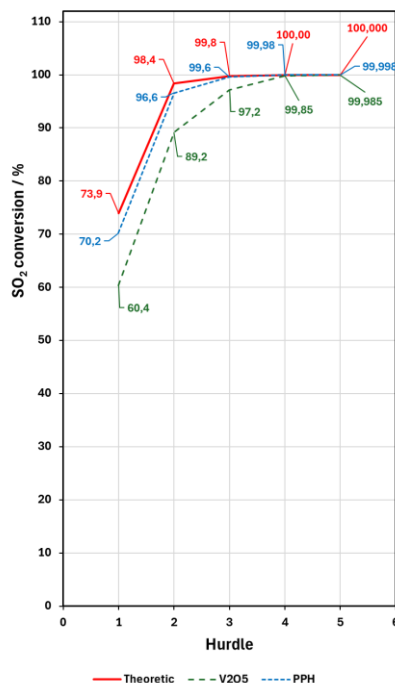
PRECIOUS METAL CATALYSTS

1000 MTPD plant 3+2 – The catalyst system (example)

Heat-up path 1st reactor



Total SO₂ conversion



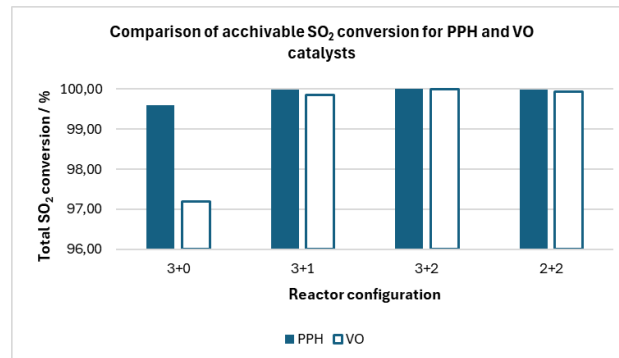
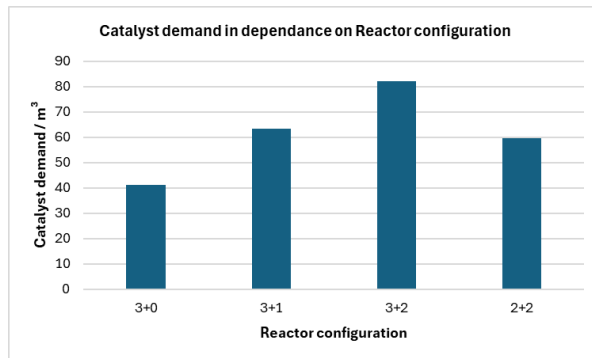
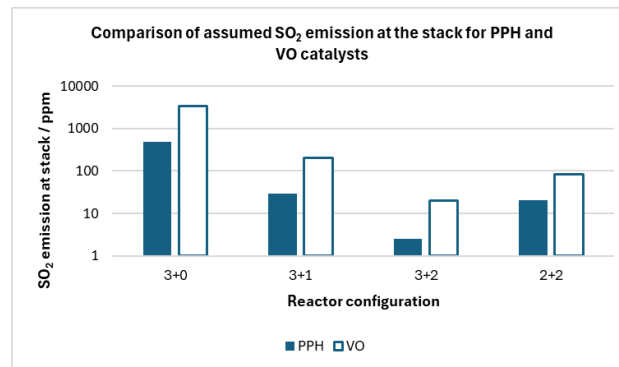
Calculation according Sulfuric Acid Manufacture Analysis, Control and Optimization Book • Second Edition • 2013



PRECIOUS METAL CATALYSTS

1000 MTPD plant comparison reactor configuration

	Reactor configuration			
	3+0	3+1	3+2	2+2
PPH / m ³	41	63	82	59
Total SO ₂ conversion PPH / %	99,59	99,98	99,998	99,98
Total SO ₂ conversion VO / %	97,19	99,85	99,985	99,94
SO ₂ emmisson at stack PPH/ ppm	495	29	2,5	21
SO ₂ emmisson at stack VO / ppm	3361	204	20	82
SO ₂ emmisson at stack PPH/ mg/Nm ³	1414	83	3	59
SO ₂ emmisson at stack VO / mg/Nm ³	9607	583	57	233
Pressure drop PPH * / Pa	1072	431	489	452



Advantages of the Pt-honeycomb catalyst:

- + **Higher turnover rates** → Lower volume, high geometric surface area, reduced CAPEX
- + **Low pressure drop** → Lower power consumption, reduced OPEX
- + **Fast warm-up** → Lower ignition temperature, reduced OPEX
- + **No attrition losses** → No screening required, reduced OPEX
- + **Recyclable** → No disposal needed, zero disposal costs, reduced CAPEX
- + **Lower toxicity**
- + **Proven in 33 plants** worldwide
- + **Retrofit capability** → in DCDA, SOP, SAR, WSA processes with immediate benefits



**Thank you for
your attention**

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