



RECONNECT

SYMPOSIUM 2022

KNOWLEDGE • OPTIMIZATION • INNOVATION

Opportunities of Safurex®

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Opportunities of Safurex®

Safurex® was introduced 25 years ago.

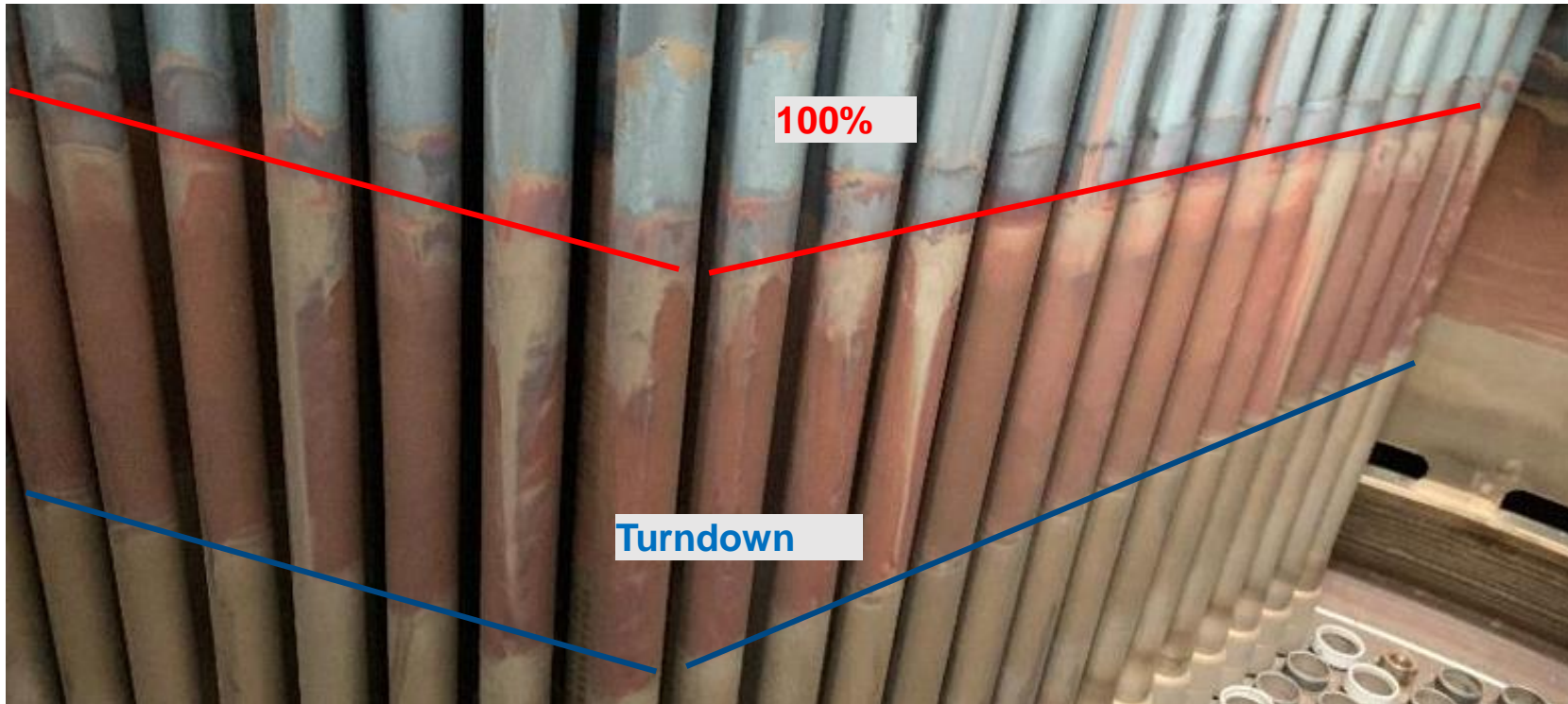
Via this workshop we like to inform you about the opportunities, a synthesis section completely manufactured out of Safurex® provides from **process** point of view.

Agenda

- Turndown ratio
- Synthesis block-in period
- Minimum oxygen content

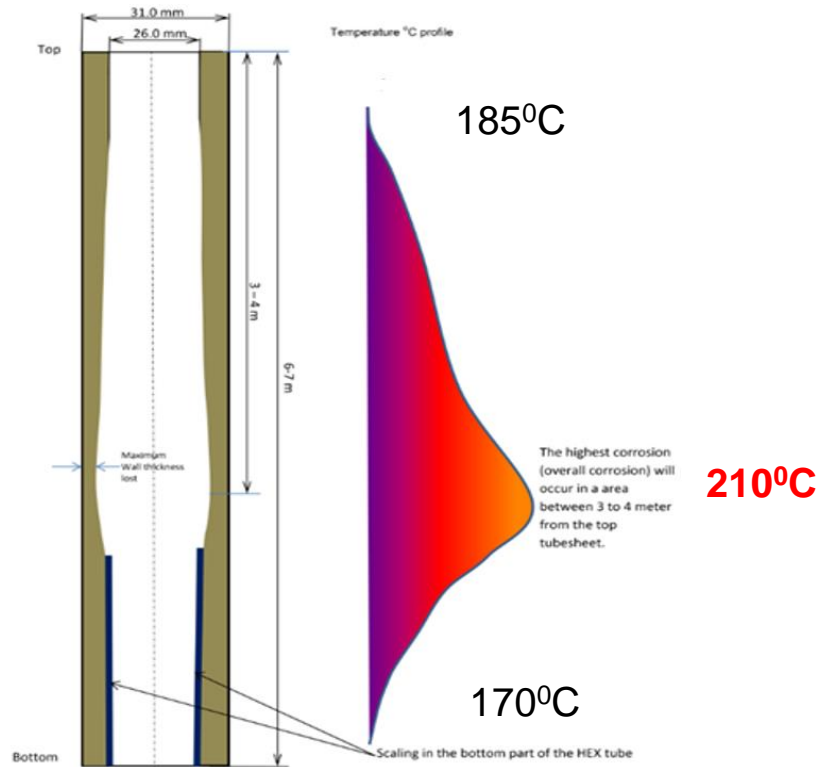
Turn down ratio of your plant

Turndown ratio



Why are we all that focused on corrosion of stripper tubes?

Turndown ratio



Stripper tubes do face the most severe conditions?

There are examples that an uneven liquid distribution did lead to active corrosion and tube ruptures of stripper tubes.

Turndown ratio of your plant

Experiences...



Three inner rows were flooding for years without increased corrosion rates.

Turndown ratio of your plant

An image of a thermal stripper

Stripper tubes without a liquid film did not lead to active corrosion.



Turndown ratio of your plant

- A client did operate their plant for weeks at 30 – 40% capacity while the plant was designed for a turn down ratio of 60%.
- No increased corrosion rate was witnessed.

Until today we can state that Safurex did not show any signs of active corrosion.

All these situations do show that Safurex® does behave significantly different compared to 25-22-2 material with respect to strippers.

Turndown ratio of your plant

Conclusion / recommendation:

- A strict turn-down ratio is not important anymore to avoid excessive/active corrosion.

Blocking in of your synthesis section

Blocking in of your synthesis section

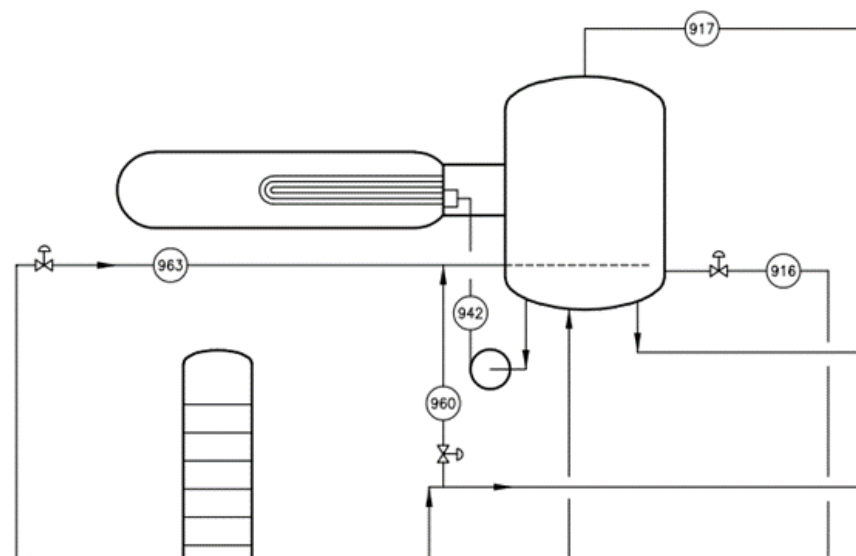
- Years ago, we visited a client which did not comply with standard block in recommendations of 24 or 72 hours.
- This client was operating a small reactor with Zirconium lining which was completely traced.

Blocking in of your synthesis section

- The recommendations by Stamicarbon were, for decades, “drain out the synthesis after a block-in period of 72 hours or in case the reactor liquid temperatures would become lower than 125°C (255°F)”
- With the introduction of a synthesis section completely manufactured out of Safurex we skipped the maximum block-in period of 72 hour. The only recommendation that remained was the minim liquid temperature of 125°C.

Blocking in of your synthesis section

- When we received questions that with a pool reactor the temperature did not drop below 125°C (255°F) anymore.
- We decided that in such a case there is no reason to drain-out the reactor anymore, just as was done with the small reactor with Zirconium liner.



Blocking in of your synthesis section

- By now the longest block-in period of a pool reactor plant reached close to 30 days.
 - The plants were able to re-start after such a long block-in period.
 - Inspections revealed no increase of corrosion rates as a result of such a long block-in period.

Blocking in of your synthesis section

Conclusion / recommendation:

As long as, during a block-in period, the temperatures in the pool reactor remain above 125⁰C (255⁰F) there is no reason to drain the pool reactor.

Minimum oxygen content

Minimum oxygen content

- Since the introduction of plants in which the complete synthesis section is manufactured out of Safurex our standard oxygen content was reduced from 0.6 vol% to 0.3 vol%.
- Ever since there was no reason to increase this oxygen content from corrosion point of view.

Minimum oxygen content

DEF production

- 1) Due to the strict quality requirements of DEF, on Iron, Chromium and Nickel more information is gathered about corrosion rates, also of Safurex.
- 2) We were informed that at low plant rates the Fe, Cr and Ni content could exceed the quality requirements of DEF.
- 3) Increasing the oxygen content did not help.

Minimum oxygen content

DEF production

To Stamicarbon this indicates that:

- 1) The corrosion rate of Safurex is in principle independent of the oxygen content
- 2) The corrosion rate is independent of the plant load which means that at low plant loads the iron, chromium and Nickel content will increase.

The best way to encounter this metal increase is to, at lower capacities, reduce synthesis pressure and/or reduce stripping efficiency.

Minimum oxygen content

Stamicarbon is of the opinion the oxygen vol% in CO₂ can be reduced to 0.1 vol% in case the synthesis section is completely manufactured out of Safurex from corrosion point of view.

The 0.1 vol% of oxygen guarantees a sustainable way of operation of the hydrogen converter which remains very important.

Minimum oxygen content

- For Stamicarbon the minimum oxygen content is more related to plant safety, avoiding combustible mixtures than related to corrosion.
- The supplied passivation air is diluting the non converted combustible components added to the urea plant via the CO₂ - and the NH₃ feedstock.

Minimum oxygen content

Example:

	CO2 feedstock Vol%	NH3 feedstock Wt%	Passivation air Vol%	Absorber off gas Vol%
NH3		99.6		
CO2	96.3			
H2O	2.6	0.4		
N2	0.3			88.5 / 92.3
H2	0.8	50 ppm		2.5 / 3.5
O2			0.3 / 0.1	9.0 / 4.2

Losing passivation air

One of the recommendations always was, “if you lose your oxygen supply for more than 15 minutes, drain the synthesis and re-passivate.”

Minimum oxygen content

For Stamicarbon the minimum oxygen content is more related to plant safety, avoiding combustible mixtures than related to corrosion.

The supplied passivation air is diluting the non converted combustible components added to the urea plant via the CO₂ - and the NH₃ feedstock.

Minimum oxygen content

- Nowadays the interlock system will shutdown the synthesis section in case of losing passivation air.
- The proper operation of the hydrogen converter is considered important which is an example of the fact that avoiding combustible mixtures did get a higher priority in safety awareness.

Minimum oxygen content

Conclusion / recommendation:

1. A synthesis completely constructed in Safurex can be operated at 0.1 vol% of oxygen from corrosion point of view.
2. The 0.1 vol% of oxygen will be required to operate the hydrogen converter in a sustainable way.

Minimum oxygen content

Summary (1)

- The turndown ratio is not that important anymore to avoid excessive corrosion of stripper tubes.

Minimum oxygen content

Summary (2)

- In a pool reactor, during block-in, the temperature can be maintained above 125⁰C (255⁰F). In such a case it is not mandatory to drain the reactor anymore from corrosion point of view.
- There are several examples that a block in period of more than 20 days did not lead to an increased corrosion rate.

Minimum oxygen content

Summary (3)

- A minimum oxygen content is related to avoiding combustible mixtures. Not anymore to corrosion rates.
- From corrosion point of view Stamicarbon supports the next step, to decrease the oxygen content to 0.1 vol% which will support the CO₂ conversion of your process.

And with these summaries we finalize the workshop

Thank you!