# The PGM value return from the owners perspective.

# Oil refining and Petrochemical Catalyst

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# PGM losses catalyst

- After PGM reclaim ➔ short in metal
- Please explain
- How to minimize
- My material balance is …

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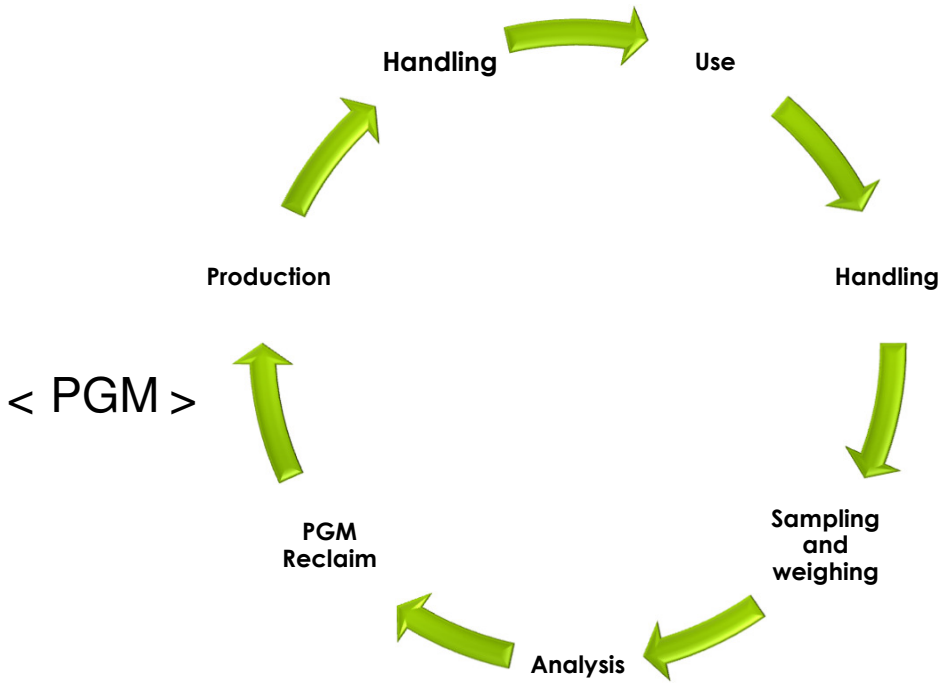
# PGM losses catalyst



# PGM losses catalyst

- PGM transfer
- Catalyst impregnating
- Loading
- Attrition by technology and by use
- Unloading
- Sampling and weighing
- Re-claim by technology and condition
- PGM transfer

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# PGM losses catalyst

- PGM transfer
  It is typically not a physical transfer of the Precious metal. It s more like when you transfer money from a bank account to another one.
  Thus there is no (significant) loss.

# PGM losses catalyst

- Catalyst impregnating
  - Depending on contract not all 100% is returned: 0,5 to 1 % losses per contract conditions?
- Some losses may occur during the preparation of the catalyst at different steps, such as impregnation between 0.5 and 2 wt% depending on the type of catalyst and method
- Concerning reproducibility, there is no standard, generally for platinum 50 ppm difference between 2 analyses is acceptable: ICP
- On new and oxide form catalysts, colorimetry can be used to measure Platinum content. ICP can be used too for Pt, Pd and rhenium (Re)
- For spent catalyst, ICP  is recommended; semi quantity FX is sometimes used
- An other technique which may be used is XRF on powder only as it is not possible to get homogeneous pearls with platinum

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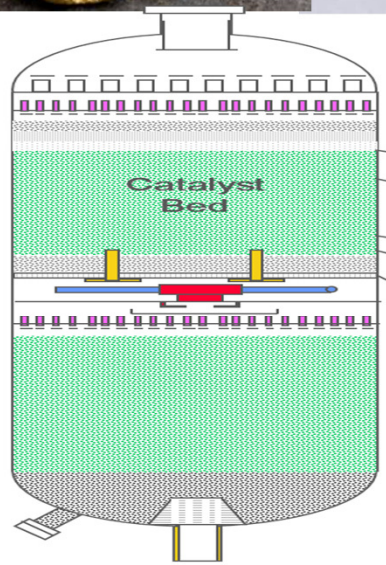


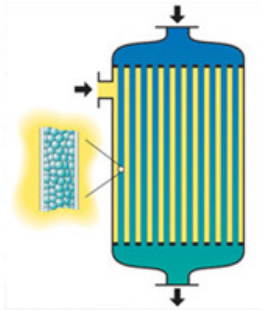

Top Bed Grading

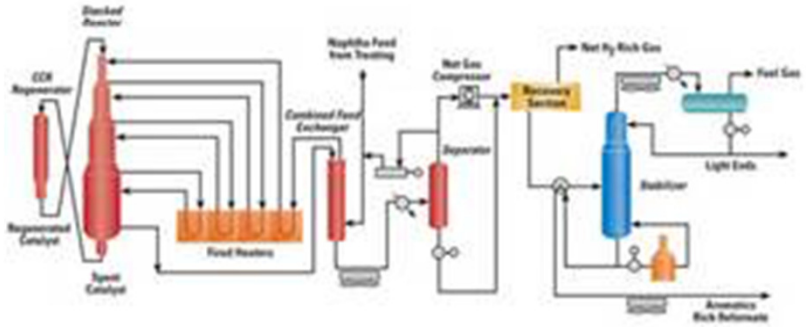
Catalyst

Catalyst

Inerts

Restricted





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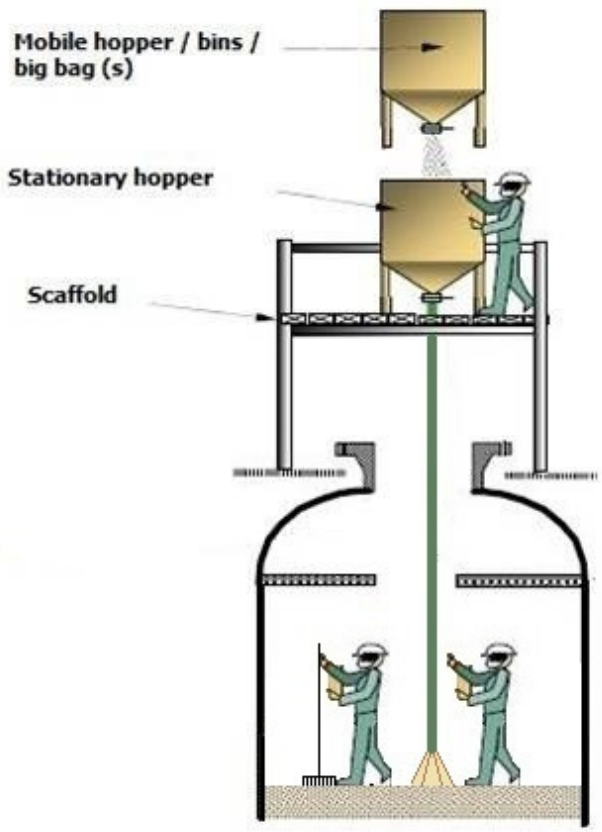
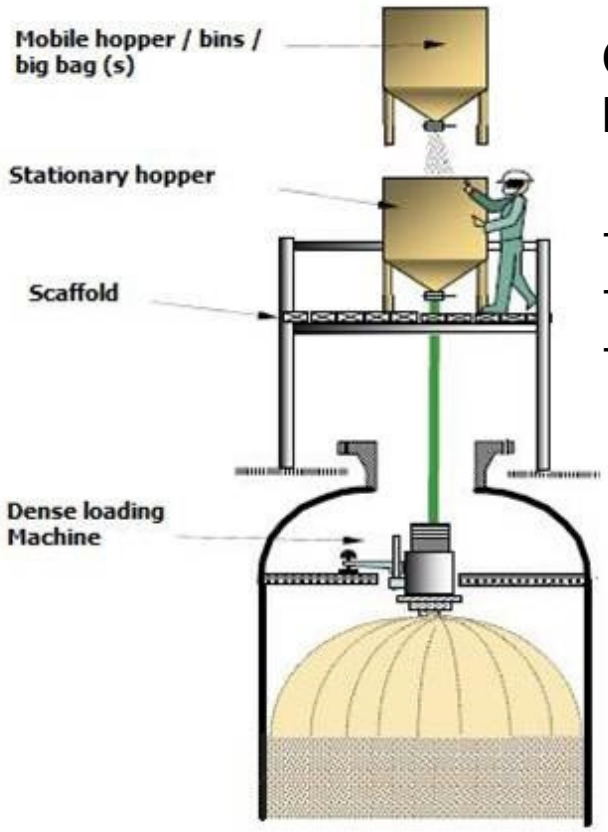
# (Un)loading catalyst: management plan in place?

- Loading and unloading




**Catalyst Unloading** like

- Airlance Unloading
- Vacuum Unloading
- Gravity Unloading

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# (Un)loading catalyst

- Fines are made during loading/ unloading: how to manage the way the catalyst is (un)loaded (vacuum or gravity) etc.... And not in the least supervised
- The evaluation of the precious metal content on the spent catalyst is not easy , because of the **sampling** which may not be representative of the full load
- During the use of the catalyst, in the case of some **specific** hydrogenation applications, some leaching may occur.

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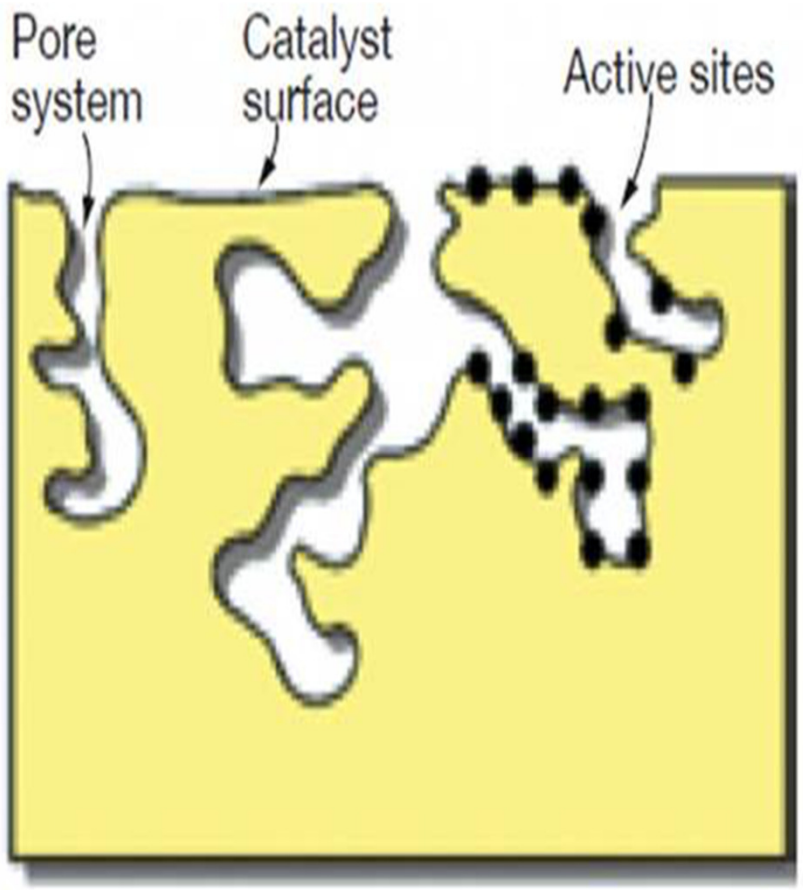
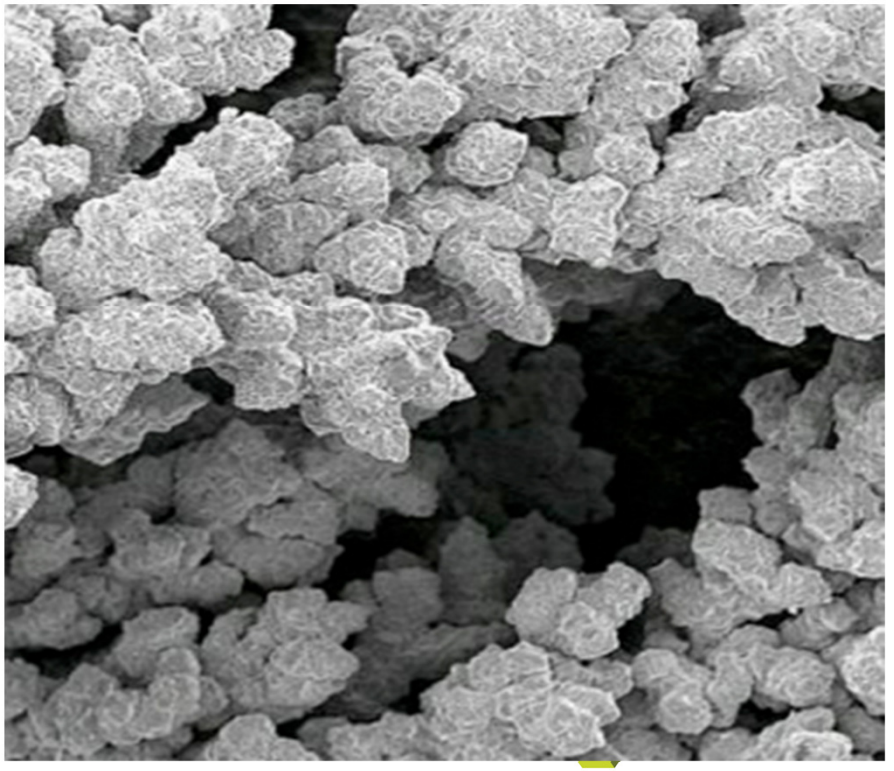
# PGM losses catalyst

- Attrition by technology and by use



# PGM losses catalyst

- Attrition by technology and by use

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# PGM losses catalyst

- Attrition by technology:  In depth impregnated catalyst will see less losses that 'surface impregnation or Egg Shell Impregnation

- Run away will lead to sintering of the precious metal and in case of reforming catalyst, a too high temperature will lead to production of alpha alumina and it´s more difficult to recover precious metal

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# PGM losses catalyst: catalyst condition

- **Matrix: (Catalyst support, alloy, kind of solution etc.)**

solids: (content) water: (content) Filter aids: (kind and content)

- **Volume** lbs catalyst plus approx. xyz lbs ceramic support balls

- **Quality** **Texture (please tick where applicable):**

lumpy, dry lumpy, wet Semisolid sludge
sludge with free liquid free flowing powder dust
free flowing granulate Solution suspension
oily(highly viscous) bars grains
metal pieces others (please fill in, if applicable):

- **Remarks: hot spots, run away….** Normal end of run conditions

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# PGM losses catalyst

- Re-claim by technology and condition
- Sampling and weighing: **LOI ≠ LOL**
- Analytical
  - Reproducibility varies a bit depending on several factors: type of catalyst, sampling methods, mesh size and concentration of PM's...among other things. That being said, under ideal conditions we can typically see a reproducibility around 1%
- There are two main analytical methods being used in the industry today:
  - Via Fire assay and some steps putting all the PM's into solution which can then be analysed by ICP-OES.
  - Wet Method used for instrumental analysis

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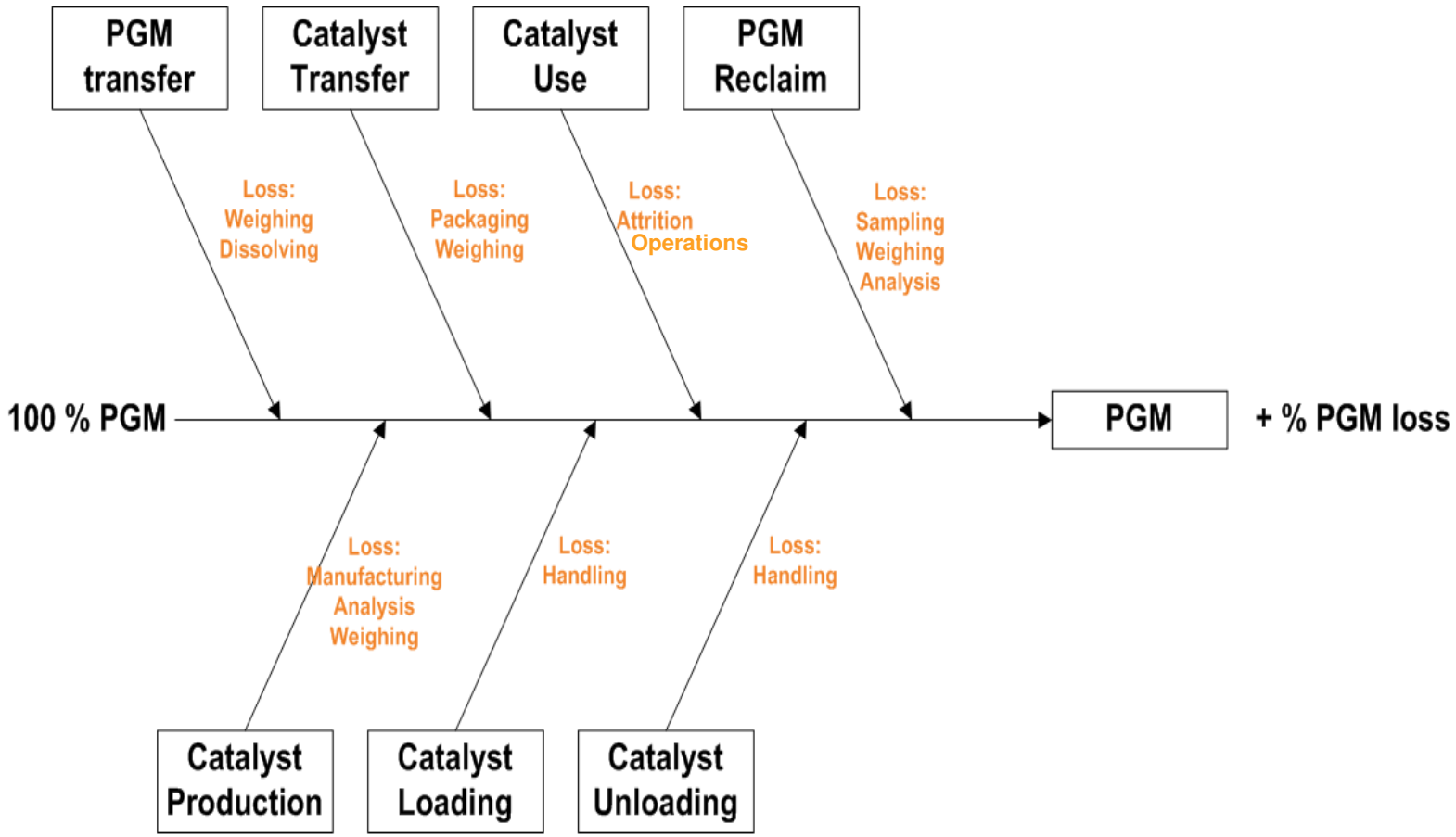
## Material Balance PGM

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# PGM losses catalyst: Material Balance

For a good PGM material balance secure all aspects of the process:

- Transfer
- Conversion
- Transport
- Catalyst manufacture
- Catalyst delivery
- Catalyst use
- (Un)loading catalyst
- Reclamation
- Analysis: LOI (temperature), Assay Exchange & Settlement, Sample preparation (ground vs pellets), Sample size, Umpire settlement, Methods
- Sampling: Sample splitting technique, Lot size, Sample retention period
- **WHAT ARE YOUR LOSSES: TWO DIGITS? WHERE IS IT?**

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# PGM losses catalyst

## Cause for loss

- PGM transfer
- Catalyst impregnating
- Loading

- Attrition by technology and by use
- Unloading
- Sampling and weighing
- Re-claim by technology and condition

## Loss contribution

- Nihil
- = < 2 %
- = < 1 %
- Catalyst properties and operations depended
- Management is key
- = < 5 %
- 1 % < = > 50 %

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# With the special help

- Peter Scherp and colleagues Axens
- Brad Cook and Algis Naujokas Sabin

Data shown is coming from industry and or including:

- Axens
- Sabin
- And others

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# Q & A