Economics and Efficiency in Sand Reclamation

MCTS Colloquium
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Jens Müller-Späth – G U T
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- about GUT
- Nobake Sand Reclamation in general
- Plant Capacity Design - less can be more
- Sand Transportation – proper Plant Engineering required
- Automatisation and Energy Saving – „low hanging fruits“
- Chromite Separation – good example on cost savings
… our name is our program

G = Giesserei = Foundry
U = Umwelt = Environment
T = Technik = Technology

… certified quality according DIN EN ISO 9001:2008
Our topic: foundry sand

Consulting, Engineering, Equipment and Service for No-Bake Foundries
Engineered solution – fit to purpose

G U T… from consulting and engineering to a turn-key plant … we design your success
Extract foundry machinery

Pneumatic Sand and Dust Conveyors

Vibratory
Lump crushers

Shake-out Devices

Sand Reclamation (mechanical, pneumatic)

Nobake Moulding Lines

Sand cooler – heater - classifiers

Sand Separation Plants (Chromite out of Silica)
Extract from reference list … more than 100 plants

... and many other valued customers
Our location in Germany and our plants worldwide

- Italy
- Norway
- Romania
- Slovakia
- Slovenia
- Ukraine
- Russia
- Sweden
- Thailand
- Serbia
- South Africa
- Belgium
- Czech Republic
- China
- Finland
- Germany
- Austria
- Switzerland
- Poland
- United Kingdom
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Quality parameters of reclaimed foundry sand

- low dust content
- constant sand temperature
- preferably only sand – no others
- always similar grain size distribution
- L.O.I. constant and preferably low
- similar surface structure of sand grains

• reproducible processes
• high quality moulds and cores

constant sand quality
Reclamation technologies

„reclaim only as much as necessary – not as much as possible!“

= L.O.I. reduction made from machines

<table>
<thead>
<tr>
<th></th>
<th>standard sand recovery</th>
<th>pneumatical reclamation</th>
<th>secondary attrition</th>
<th>thermal reclamation</th>
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<tbody>
<tr>
<td>L.O.I</td>
<td>0</td>
<td>+</td>
<td>++</td>
<td>++</td>
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<tr>
<td>loss of sand</td>
<td>++</td>
<td>0</td>
<td>-</td>
<td>++</td>
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<tr>
<td>investment</td>
<td>+++</td>
<td>+</td>
<td>0</td>
<td>–</td>
</tr>
<tr>
<td>sand costs</td>
<td>+++</td>
<td>+</td>
<td>0</td>
<td>–</td>
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</table>
Miracle sand reclamation system . . .

... sorry – we donnot have – but good systems for various applications
Shake out – 3 D Engineering
Shake out with sound isolating cabin
Shake out
... in case shake out grid is to small !!!
Sandbehandlungsstationen.
Entstauben, kühlen oder erwärmen.
Plant Capacity Design

„high capacity areas“
... everywhere where labour is involved!
(ideally machines are faster than workers)

capacity: 30 t/h

„lower capacity areas“
- machines runs 24 hours in „automatic mode“
- less capacity, but storage hoppers required to balance different requirements during a working day
- lower investment costs
- lower energy consumption

capacity: 10 t/h

... everywhere where labour is involved!
(ideally machines are faster than workers)

machines runs 24 hours in „automatic mode“
less capacity, but storage hoppers required to balance different requirements during a working day
lower investment costs
lower energy consumption
Plant Capacity Design

Potential savings on:
- Investment costs
- Filter plant capacity
- Water re-cooling plant capacity
- Air compressor capacity

larger storage hoppers but significant less equipment
Economical Plant Capacity Design …

… saves investment costs
(less or smaller sand reclamation machinery)

… saves running/operating cost, because of
  • lower energy consumption
  • less Maintenance costs

Examples:
  • filter plant for 40,000 m³/h instead of 60,000 m³/h
  • Water Recooling Plant „only half size“ if it can operate 24 instead of 12 hours
Sand Transportation, Sand Conveying

- usually nobake foundries use a huge amount of sand for moulds and cores (in average 4-5 times more than their net casting production, 1 ton casting needs 4-5 tons of sand)
- usually sand needs to be conveyed several times in between shakeout and mixers (from shakeout to lump crusher, from lump crusher to cooler, ...)
- Sand transport costs are a considerably portion of total cost for sand reclamation
- Share on energy cost per ton of reclaimed sand is usually higher than amortisation

Foundry layout / Sand reclamation plant layout influences both, economy and efficiency ... „Engineering“ matters a lot!
Sand reclamation plant with chromite separator
Secondary Attrition Units …

- are mostly missing in South African Foundries (and also in Germany)
- increase quality of reclaimed sand
- are much cheaper on investment and running costs than thermal reclamation
- needs minimum space
- needs only very little energy
Rotary reclamer - FKR (Firma Klein)
FKR – Rotary Sand Reclaimer
Grinding reclaimers: function

- pot
- grinding tool
- sand
New generation basic machine – Eirich R12W

- av. batch size: 420 kg
- easy accessibility
  (pan cover and tool can be tipped up completely)
- automatic central lubrication
- high energy input into the mix
Single line setup – capacity: up to 3 t/h
Mechanical intensive reclamation – Alpha Set Input Sand
Mechanical intensive reclamation – Alpha Set Sand

Reclaimed sand – 10 min
Results – grinding reclamer

Glühverlust

<table>
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<th>Material</th>
<th>AS</th>
<th>REG-6min</th>
<th>REG-12min</th>
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<td>Croning-TAM</td>
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<tr>
<td>Bentonit</td>
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<td>Phenolharz</td>
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Ausbringung

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<tr>
<td>Phenolharz</td>
<td>100</td>
<td>75</td>
<td>50</td>
</tr>
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Automatisation and Energy Saving

... on new cars automatic „start-stop“ of the engine has become a standard feature.

... what about Sand Reclamation systems in Foundries?

... very often many drives have only a simple „on/off“ switch – resulting in unnecessary running times.

- Intelligent Plant software ...
  - ... switches unnecessary running drives off and re-starts them automatically if required, f.e.: filter and water re-cooling plants
  - ... can save easy 5-10 % of energy cost of main and auxilliary machinery
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➤ Chromite Separation – good example on cost savings
Flowchart Sand Reclamation and Chromite Separation

Chromite separator = last step in sand reclamation process
GUT Chromite separation – 4 step technology

4 steps = separation result suits reuse in steel foundries
Highlights

- average recovery rate about 80 %
- short R.O.I.
- very low energy consumption
- more than 50 plants running
- blend of 80 % reclaimed and 20 % new Chromite recommended for re-use
- proofed for Furan / Pepset / Alphaset / Phenolic / Alkydic Resins
Example: Economic Analysis 1

Example:

Chromite Separation Plant

Basic Approach:

Calculation of average sand costs

Boundary Conditions:

- Steel Foundry,
- Portion of Chromite: 15%,
- 10,000 tons of good castings per year,
- Sand : Metal Ratio = 4 : 1
Example: Economic Analysis 2

Dumping Costs: 20 €/t
Running costs for sand reclamation plant: 10 €/t
Running costs for chromite separation: 2 €/t

Potential Savings:
50% of total sand costs,
or: approx. 20 € per ton of sand,
or: approx. 800,000 € per year

<table>
<thead>
<tr>
<th></th>
<th>Total Sand per year</th>
<th>New Sand costs</th>
<th>Amount of new sands (without chromite separation)</th>
<th>Amount of new sands (with chromite separation)</th>
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<tbody>
<tr>
<td>Silica</td>
<td>34,000 t</td>
<td>35 €/t</td>
<td>3 %</td>
<td>3 %</td>
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<tr>
<td>Chromite</td>
<td>6,000 t</td>
<td>170 €/t</td>
<td>100 %</td>
<td>20 %</td>
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</tbody>
</table>
Chromite Separator Plant
left: ECO-FORM  rigth: standard
... specialists for nobake foundries!

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