To reduce the cycle time of Re-homogenization process for billets (currently ~ 8 Hours)

Dubai Aluminium (DUBAL)

Department:
Product & Casting Operations - Metallurgical Services

Project Team:
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13-14 November-2013

WQD, Live Competition 2013
“Before” Situation

As-is Process Map - Billet

<table>
<thead>
<tr>
<th>Start</th>
<th>Casting</th>
<th>90 min.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Ultrasonic Inspection</td>
<td>60 min.</td>
</tr>
<tr>
<td></td>
<td>Homogenizing</td>
<td>480 min.</td>
</tr>
<tr>
<td></td>
<td>If transfer &gt;15 min.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Homogenizing</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Final Inspection</td>
<td>30 min.</td>
</tr>
<tr>
<td></td>
<td>Cutting &amp; Strapping</td>
<td>210 min.</td>
</tr>
<tr>
<td></td>
<td>Stockyard Storage</td>
<td></td>
</tr>
<tr>
<td>End</td>
<td>Final Inspection</td>
<td></td>
</tr>
</tbody>
</table>

Cycle time per cast - with Re-homo (min)

- Re-homo: 480 min. extends cycle time by 43%
- Homo: 480 min.
- Cooling: 240 min.
- Cutting/Strapping: 210 min.
- Casting: 90 min.
- U/S Inspection: 60 min.
- Final Inspection: 30 min.

Reasons of Delays

- Homo furnace door not opening
- Breakdown of transfer car
- Cooler not ready
- Cooler door not opening
- Others

➢ Batch Homo is a bottleneck in the homogenizing process due to delays
“Problem” Statement

- Batch Size = ~50 MT
- No. of Logs: depend on diameter of the logs

- Alloy all series/all dias – total homo cycle time is **8-11 hrs**
- Current Re-homo practice (as per DUBAL procedure) include an additional **throughput time of 8 hours (480 min.) per batch** – minimum
Root Cause Analysis

The team conducted a **5 Why Analysis** on the basis of **As-Is Process Map** as below:

1. Why throughput time is high for some of Batch Homo Furnace?
   - Delays due to re-homogenization

2. Why re-homogenizing?
   - Delays in load transport to cooler and/or cooler trips so re-homo has to be done and it takes very long

3. Why re-homo takes very long?
   - Because full homo cycle to be given for such loads

4. Why full homo cycle for such loads?
   - To get Mg$_2$Si back into solution

5. Why Mg$_2$Si to be backed into solution?
   - To ensure billet product’s quality not compromised

**Conclusion:**
- **Re-homo practice** has been identified as one of special requirements to achieve certain properties
- Only **Mg$_2$Si needs treatment** – rest of the properties remains unchanged
## Improvement Plan

The team agreed the below action plan:

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Action Point</th>
<th>Responsibility</th>
<th>Target Date</th>
</tr>
</thead>
</table>
| 1     | **Review the Metallurgical Requirements in details and understood the applicable physical and chemical properties**  
- Revision of customer requirement  
- Metallography related tasks such as hardness measurement, & spherodisation, etc  
- Establishment of new re-homo practice | Metallurgy Services             | July, 2013 |
| 2     | **Revise re-homo practice with a total cycle of 8 Hours (excluding cooling) to ensure no compromise on metal quality elements**  
- Issuing the procedure  
- Setting the new cooling rate recipe in cooler control panel  
- Changing the programme in AS400 | Metallurgy Services & PC & Maintenance | July, 2013 |
| 3     | **Conduct trials for the alloy AA6060, AA6063, & AA6061, dia 203, 228, 254, & 305 mm and transfer the load to Cooler-2** | Metallurgy Services & Process Control & Casting Operation | Aug, 2013 |
| 4     | **Observe the process practices and collect samples**                                              | Metallurgy Services             | Sep, 2013   |

⚠️ Specific responsibilities assigned to various team members
After Situation

**Modified Re-homo**
- From **480** minutes to **40** minutes

- No compromise on quality (no change in the inter-metallic particle, hardness and mechanical properties by modified re-homo practice)
Benefits

- Approximately **7 Hours** saving in re-homo practice
  - Reduced throughput time from **8 Hours to about 1 Hour** (∼90% reduction in throughput time)
  - Opportunity of homogenising/cooling **192 extra loads/year** (∼50 MT per load)

- Overall opportunity gain of
  - **9,600 mt/year** more **Billet** output for DUBAL
  - **AED 4.5 million/year** for DUBAL
Standardization

✓ Devised and established all necessary changes in SCADA/MES and PLC

✓ Update Procedures and AS-400 System to ensure new cycle is being part of process
Horizontal Deployment

• Extended to all batch homo furnaces
  ✓ Casthouse-1: BH Furnaces 1, 2, 3, 7 & 8
  ✓ Casthouse-2: BH Furnaces 4, 5 & 6

• Application of the improved Re-homo practice in case of any failure in load movement for all Billet alloys/diameters.
"Challenge the process" - key to enhance the value to Customers and DUBAL

Area Owner’s Comment:

“This project has improved the overall productivity of people, equipment and other resources of Casting Operations by reducing the time of this cumbersome practice of re-homogenization during regular operations.”

Fadi Awadhalla – Senior Manager Billet Operation
Question & Answers
Thank you