The Fifth Assaying & Refining Seminar

Continuous Casting of Silver Bars

Dr. Peter Tews

London 11th March 2013
Activities and product range

<table>
<thead>
<tr>
<th>PM - Analytics</th>
<th>PM - Trade</th>
<th>PM - Recycling</th>
<th>PM - Products</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Allgemeine & Umicore Core Business

- **PM Products**: High quality, well-controlled
- **PM Refining**: Reliable, quick, and effective
- **Analytical Lab Services**: Quick and reliable
- **Responsible Precious Metals**: Supply advantage

*Image of Umicore brochure*
Allgemeine - Ag situation in 2012

Ag consumption in products dropped dramatically, increase in refining capacities and production

Free capacities for semi fabricated products

Granules are not sellable in the market

No bar casting unit available

LBMA - rule open bar casting

LBMA request for the new bars in March 2012

Providing the drawings

Preparation of the first sample

Accepted by Physical committee in June 2012
Process - Premelting, assaying and casting

Premelting of Granules, Crystals

- Induction Furnace, 400 kW
  Capacity 500 kg

- After homogenization, sampling and analyzing with spark analyzer in 10 min during the process
  25 possible impurities and oxygen content

- Approval or stoppage of the furnace

- Transfer of silver in casting furnace

Process - Casting

Bar casting

- Induction bar casting furnace 1000 kg
  Casting Speed 550 kg/h
  Temperature: 1150°C

- Analyzing after transfer each new 500 kg batch from the pre-melting furnace, spark analyzer
  process control and final analyze

- Secondary cooling unit
Process - Cutting

Cutting

- In-line-cutting of the endless bar in pieces, 305 mm long
- Packed in 500 kg batches correspondent to one premelting furnace transfer to the other

Process - Milling

CNC-Milling

- To produce the undercut on the ends of bars and round the edges
- Dry milling without any contamination
- Process time: 5 min/2 bars
- Amount of chips: 7%
- Chips can be returned
Process - Weighing, Marking and Packaging

Weighing, Marking and Packaging

- Pair of scales and computer supported programmable dot matrix engraving system are directly connected
- Bar weight is copied to the engraving system
- Generating automatic weighing list
- Packaging for transport
  Special effort due to the extremely flat surfaces

Conclusion

- First LBMA continuously cast Silver bar
- 3 months from Idea to the accreditation
- Using the Production capabilities and the well trained staff
- Production in 9999 and 999 quality without any visible differences
- Highly visible quality, independent from different rest impurities in refined silver
- Direct use of electrolytically recycled (washed and dried) silver crystals
- Efficient alternative for Allgemeine
- In December 2012 we celebrated the 10,000th continuous cast Silver bar
- Many thanks to LBMA, the Physical committee and Chief Executive Stewart Murray for their support
Thank You very much for your Attention