Using technology to reduce waste and costs in the secondary lead production

Massimo Maccagni, R&D Manager
Secondary lead production higher than primary: 6500 kt/y vs 5000 kt/y

Lead acid battery manufacturing dominates the world lead consumption (85%)

Lead acid batteries represent the main source for secondary lead plants (97% recycled)

Severe environmental protection laws are worldwide extended.

Technological improvements are mandatory!
Years passed, technology grew ...
.... a lot of improvements were introduced ..... but the story is not going to end
The lead acid battery recycling started with dry processes

- **Direct fired rotary drier**
  - Fed with ebonite batteries crushed inside a drum
  - Paste was dried and separated from grids
  - Grids were separated from the rest in a sink and float unit based on heavy media (paste slurry)

As a result

- Heavy pollution in the plant (dust)
- Grids and plastics heavily contaminated with paste
- Exhaust from drier contaminated with SO$_2$ and lead dust
- Paste was not suitable for desulphurization
  - Big presence of grids and plastics (pumpability).
The immediate result was the reduction of the environmental impact.

Improvement of the in-plant air quality:
- Lower emission of SO₂
- Sucked air from all the machinery
  - Washed in a special wet scrubber
  - Pb from the previous 50 mg/Nm³ to less than 1 mg/Nm³
Wet process with desulphurization and oxy-fuel burners

- Drastic reduction of slag from the furnace (<10% on Lead)
- Drastic reduction of SO₂ emissions from the smelter (< 200 mg/Nm³)
- Introduction of 100% oxy-fuel burners
  - Lower emissions of NOₓ and CO
  - Higher productivity (30% more)
  - Fuel saving (30-40% reduction per unit of lead)
  - More flexibility during the smelting operations
  - Less fumes
    - better the working condition for the bag house
  - Complete combustion of the small plastics chip still present in the paste
    - higher temperature of the flame
    - higher residential time of the exhaust inside the furnace
Environmental impact

Dry process
Wet process
Desulphurization & oxy-fuel
Super-desulphurization

Time

2005
Introduction of the Super-desulphurization

- Maximum removal of sulphur from paste
- Application on drained batteries
- Easier smelting
  - Highest reduction of $SO_2$ emission (< 50 mg/Nm$^3$)
  - Highest reduction of slag production (< 5% on Lead)
  - Reduction of matte production
  - Reduction of Pb loss through the slag
Paste E.W.

- Practical elimination of SO₂ emissions
- Small furnace and mainly for melting
  - Smelting small amount of leaching residue
  - High minimization of slag production


The first mechanized system

1960 - 1965
40 t/h Battery Breaker

Engitec Technologies S.p.A.
3 t/h Battery Breaker
Flat vibrating screen

Rotary screen
Super-desulphurization
Furnace: automatic charge preparation
Furnace: charge mixing ....

...... and feeding
45° Tilting rotary furnace
Double pouring

N° 2 x 10 m³ rotary furnaces
130 tpd of Pb / each
Grids melting furnace
1-ton hogs casting machine
Automatic ingots casting-stacking machines
Refinery
With this configuration the lowest emissions in secondary lead production were achieved
New possible fields of developments

- Electrolyte recycling
  - Avoiding conversion to salt
  - Closing the battery recycling
- Development of hydro approaches
- Rotary furnace heat recovery
Conclusion

- **Battery recycling**
  - A long story of successful improvements
    - Technical improvements
    - Environmental improvements
  - Demonstrated the possibility to reduce environmental impact without penalizing the economics of the process
    - Practical elimination of SO$_2$ emissions
    - Drastic reduction of slag and powders production
    - Cut of energy consumptions
    - Cut of reactant consumptions
    - Increase of the productivity of smelters
  - The future
    - Optimization of energy balance
    - Hydro/E.W. Processes
    - Further optimization of resources
www.engitec.com
20026 Novate Milanese (MI)
Italy
Tel. : +39 02 38207203
e-mail: m.maccagni@engitec.com

THANK YOU FOR YOUR ATTENTION
ARRIVEDERCI !