



**Centre for Mineral Technology** 

Ministério da Ciência e da Tecnologia

# Non-Ferrous Metals Recycling Economic, Technical and Environmental Aspects of Aluminium and Lead Market in Brazil

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# Recycling for Sustainability of Mineral and Materials Industry

#### On one hand it means :

- Extending natural resources lifetime
- Reducing costs and wastes
- Enforcing energy conservation

#### But on the other hand it demands :

- Protection of human health and environment
- Clean materials recovery techniques
- Well-organized collection system
- Large markets for recycled materials



# Design for Recycling and for Materials Separation

- Clean recycling process is a key issue for the emerging recycling industries that are often linked to complex waste streams from end of life products (ELP).
- Economic viability of recycling of such ELP depends on products design and materials separation.

### Non-Ferrous Metals Recycling in Brazil

- We are going to present here some examples of nonferrous metals recycling in Brazil in two main axes:
- 1. Market pulled materials that have impressive economic advantages such as Aluminium, that has in Brazil one of its greatest world market for can recycling.
- 2. Materials that claim for new and clean technologies and sound recycling process management avoiding extra environmental impacts such as lead from car batteries.
- It's also important to notice that Aluminium and Lead from car batteries are the best opportunities for Brazilian recycling industry.

# Brazilian Mineral Production of Main non ferrous metals

Minerals	Specifications	1995	1998	In tons 2001 <sup>(p)</sup>
Aluminium	n Primary Metal	1 188 000	1 208 000	1 140 000
	Recycled Metal	92 000	170 000	200 000
Copper	Primary Metal Secondary Metal	164 966 54 400	167 205 54 150	212 243 36 000
Lead	Primary Metal Secondary Metal	13 958 50 000	- 48 000	- 52 000
Zinc	Primary Metal Secondary Metal	188 033 7 000	176 806 ND	193 061 ND
Sources: DNPM, Mineral Summary 1994, 2000, and 2002 Notes: (-) Null (ND) Not determined (p) Preliminary				

#### Apparent Consumption of Metallic Lead Products in Brazil (1997-2001)

1998 1999 2000

Production (secondary lead)\*
53 48 52 52 52 (secondary lead)\*
Import 60,7 60 56 70,7 73,4

1997

Consumption 113,7 108 108 122,7 125,4



2001

## Evolution of Aluminium Recycling from Aluminium Cans from 1991 to 2002



Source: ABAL (Associação Brasileira do Alumínio)

#### **Brazilian Aluminium Market**

- Brazil is the sixth greatest primary Al producer in the world after USA, Russia, Canada, and Australia
- The Al industry employed around 50 thousand people in 2000
- And generated an annual income of US\$ 5,7 billions which represented 1,1 % of the Industrial National Product
- 150 thousand people are directly involved in collecting Al cans

## **Aluminium Recycling Strengths**

- Energy Saving (95% less than mineral processing)
- More Cost Effective (specially for AI pure forms)
- Large Markets
- Easy to collect (from packing or industrial scrap)
- Easy to sort from aluminium scrap or cans
- Good level of R&D investments

### **Aluminium Recycling Weakness**

- Aluminium alloyed with other metals such as copper, magnesium, sillicon, zinc and iron for aerospace, automotive and other industrial uses
- These Al scrap often includes lacquers, paints, and plastic coatings.
- The Al for automobile uses has introduced dozens of alloys which must be separated to prevent downgrading of the secondary Al products.

# **Technological Challenges**

- To get an environmental sound management of Al production (ABAL/ IPT partnership new furnace by plasma instead of the traditional Alcan oxidizing process, www.ipt.br/inovaçao/exemplos/aluminio/riqueza/)
- To develop clean technologies for AI sorting and reprocessing reducing the level of impurities and wastes.
- New processes to separate mixed Al scrap preventing downgrading of secondary Al product.



## **Recycling Lead from Automotive Batteries main economic and technical aspects**

- Scrap automotive batteries are the major source of Secondary Lead in Brazil as all over the world
- The main environmental issues are the risk of water, soil, and air contamination by hazardous wastes
- Additionally to lead, automotive batteries have also acids other metals -arsenic, antimony, tin, calcium- in suspension and solution.
- Pyrometallurgical refining is the most used process worldwide for both primary and secondary lead production.
- Hydrometallurgical methods are the soundest technology to lead refining but its economic viability has to be proved.

#### Pyrometallurgy X Hydrometallurgy the R&D towards Best Practices

- Pyrometallurgical process had to be improved to face the environmental requirements as the new hydrometallurgical methods did.
- The researches on hydrometallurgy for lead refining were made by Bureau of Mines by the end of the 70's. First papers were published in 1981.
- First industrial processes were provided by Engitec Technologies in 1992- CX-EW and CX Compact -.
- In Brazil CETEM carried a 5 year research on hydromettalurgical processes for recycling domestic batteries as well as automotive batteries.

#### The Recycling Loop of Lead/Acid Batteries in Brazil



#### Guidelines on Lead Recycling presented to Basel Convention Secretariat

#### Pre- Recycling steps: Collecting and transporting

- collection points must store the batteries in proper place, not in too large amounts, not sell them to unauthorized lead smelters, and batteries should not be drained at the collection points
- Batteries must be well packed to be transported inside containers and handled by trained people with adequate equipment. Besides that the transport should be identified by symbols and follow a predefined schedule and map.

At Recycling level: filters and other pollution prevention and effluents treatment are also specified.

#### **Basel Convention and Brazilian Environmental Regulation on Lead/Acid Batteries Recycling**

- Basel Convention (1989 Switzerland) was first conceived to control the movements of hazardous wastes and their final disposal became part of the Brazilian Environmental Law on July 1993.
- In 1994 Basel Convention banned all exports of hazardous waste for final disposal and recycling from developed to developing countries.
- After backs and forwards the CONAMA's Resolutions 228/97, 235/98 and 257/99 classified the used lead/acid batteries as hazardous waste and prohibited their import.







#### **Geographic Distribution of Lead Recyclers in Brazil**





#### **Implications to Brazilian Lead Market**

- Most of lead recycler companies were shut down by economic and environmental reasons
- There are still a number of informal recyclers operating under risky situation to public health and the environment
- Recent Greenpeace investigations revealed that Moura, one of the largest manufactures of car batteries in Brazil, is still importing scrap lead acid batteries.



### Threats

- The lack of a National Programme for collecting vehicle batteries
- The large number of irregular final disposals (90% of the Brazilian municipalities)
- The environmental legislation is not enforced by an effective system at local level.
- There is an important informal sector dealing with recycling activities.
- There is a well-established lobby of big companies that are producers and recyclers of batteries.



# Challenges to a National Policy for a Sound Recycling Management

- Improve and control the collection system
- Minimize the transportation of hazardous waste
- Promote the development of clean recycling technologies
- Extend the polluter-pays principle to the producers concerning end of life products
- Encourage the design for environment and for recycling practices