

Josep Poch March 07

# Aluminium (Al)

The image shows two rolls of aluminum foil against a blue background. The roll on the left is partially unrolled, showing the shiny, reflective surface of the foil. The roll on the right is also partially unrolled, with the foil draped over the surface. The text 'Aluminium (Al)' is overlaid in the center of the image in a bold, grey, sans-serif font.

# Introduction

- ▶ Aluminium is the **third most abundant element** in the Earth's crust and constitutes 7.3% by mass
- ▶ In nature it only exists in very stable **combinations with other materials**
- ▶ It was not until **1808** that its **existence was first established**. It took **many years** of research to "unlock" the metal from its ore and many more **to produce** a viable, commercial **production process**

# History (I)

- ▶ **1808** Sir Humphry Davy (Britain) established the **existence of aluminium**
- ▶ **1821** P. Berthier (France) discovers a hard and reddish material containing 52% of  $\text{Al}_2\text{O}_3$  near the village of Les Baux in France. He called it **bauxite**, the most common ore of aluminium



Bauxite mineral and bauxite mining in Guinea (Africa)



# History (II)

- ▶ **1855** A bar of aluminium, the new **precious metal**, is exhibited at the Paris Exhibition
- ▶ **1886** Two young scientists, Paul Louis Toussaint Héroult (France) and Charles Martin Hall (USA), working separately simultaneously invent a **new electrolytic process**, the Hall-Héroult process, which is **the basis for all aluminium production today**

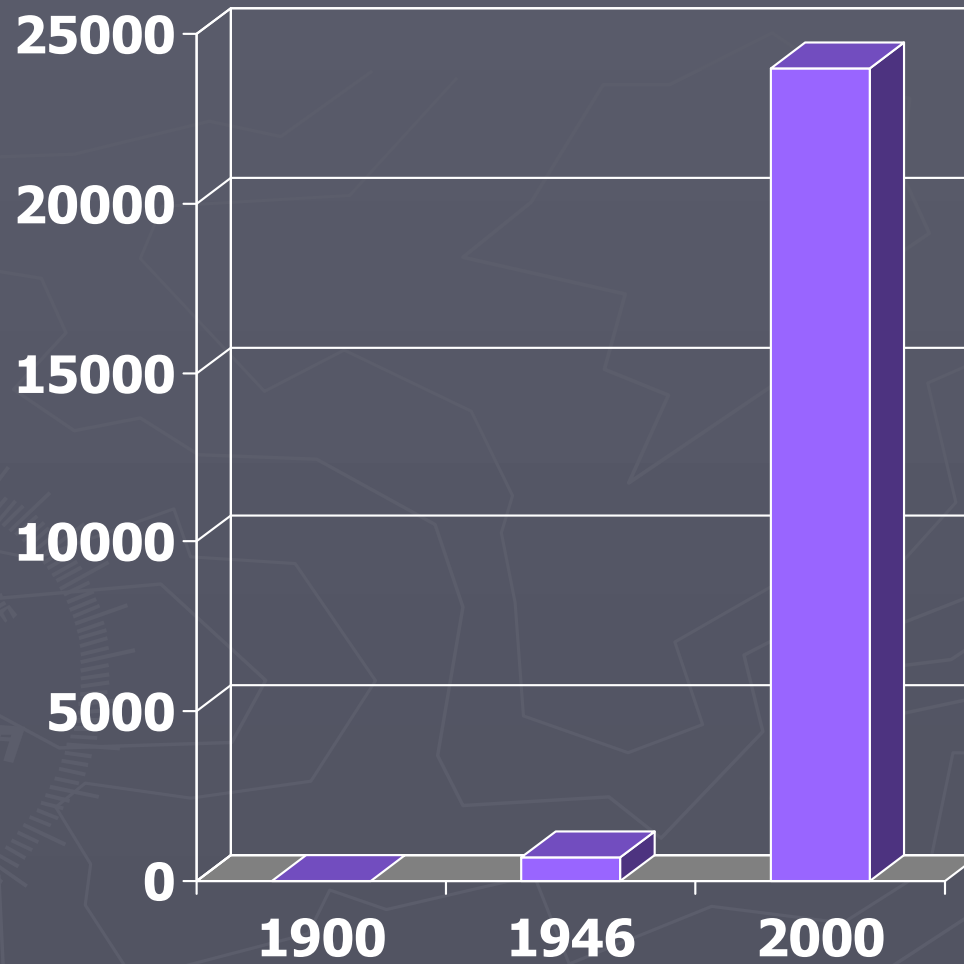


Paul  
Héroult



Charles  
M. Hall

# History (III)



**World Production**

■ thousand tonnes

# Aluminium production

## RAW MATERIALS

Bauxite (5t)  
Fuel  
Electric Energy (15MWh)  
Chemical products



Alumina ( $\text{Al}_2\text{O}_3$ )

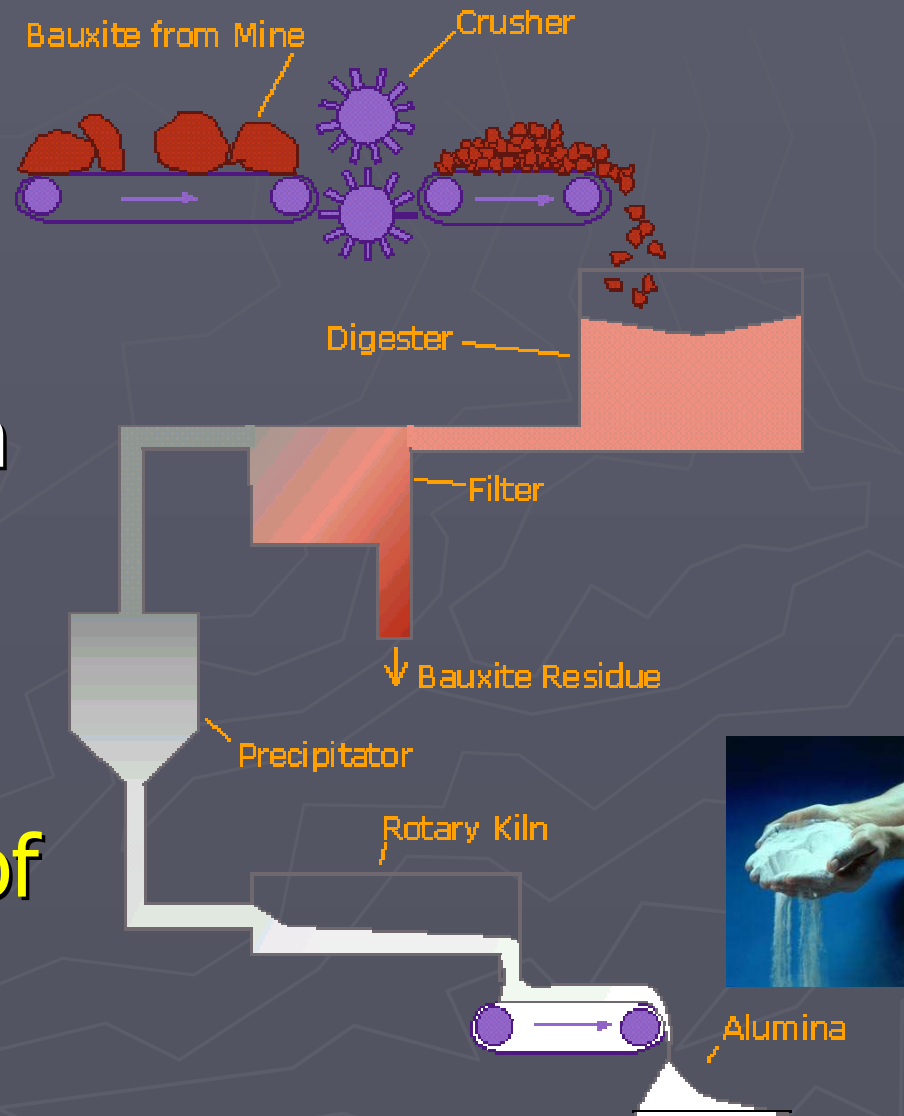
## FINAL PRODUCT

Aluminium (1t)  
**WASTE**  
Chemical waste  
 $\text{CO}_2$



# Alumina production

- ▶ The aluminium industry uses the **Bayer process** to produce alumina from bauxite
- ▶ Some **5 tonnes of bauxite** are required to produce **2 tonnes of alumina** ( $\text{Al}_2\text{O}_3$ )



# Obtaining Al from $\text{Al}_2\text{O}_3$

- ▶ Alumina is reduced to aluminium metal in electrolytic cells known as pots
- ▶ From 2t of alumina we get 1t of aluminium



A modern pot line - this one can produce over 200 000 tonnes of aluminium per year





# Aluminium applications

## Some current uses

### ▶ Transport



Cars,  
planes,  
fast  
trains

### ▶ Electricity



High voltage lines are made of aluminium: it's conductor, light and resistant to corrosion

### ▶ Packaging



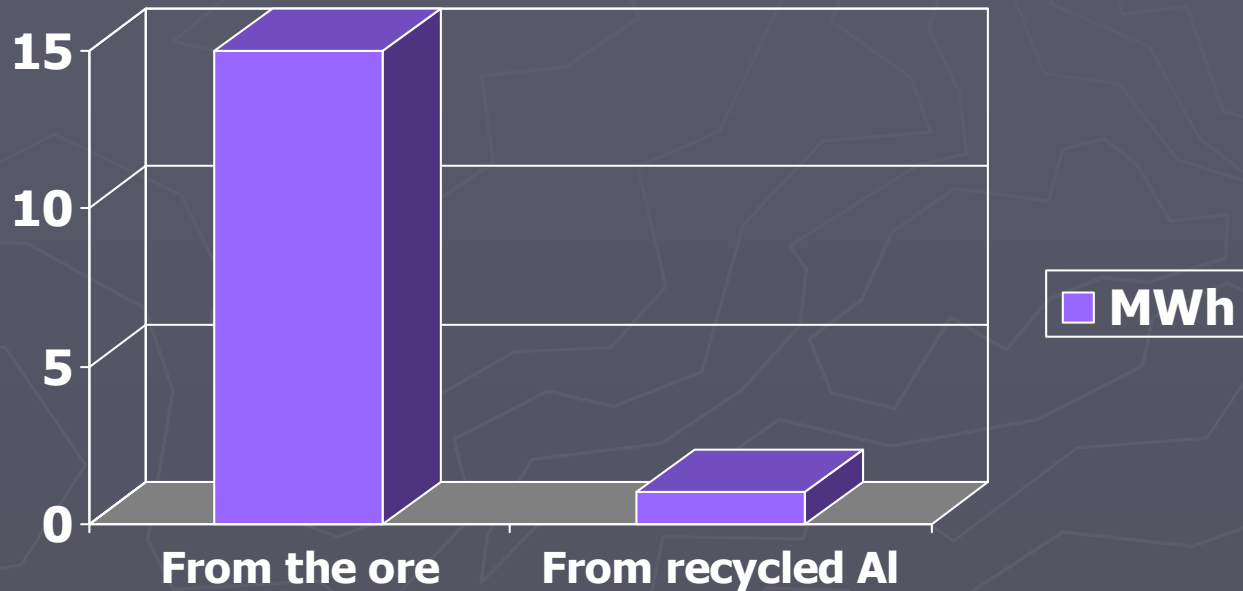
### ▶ Construction, cookware...



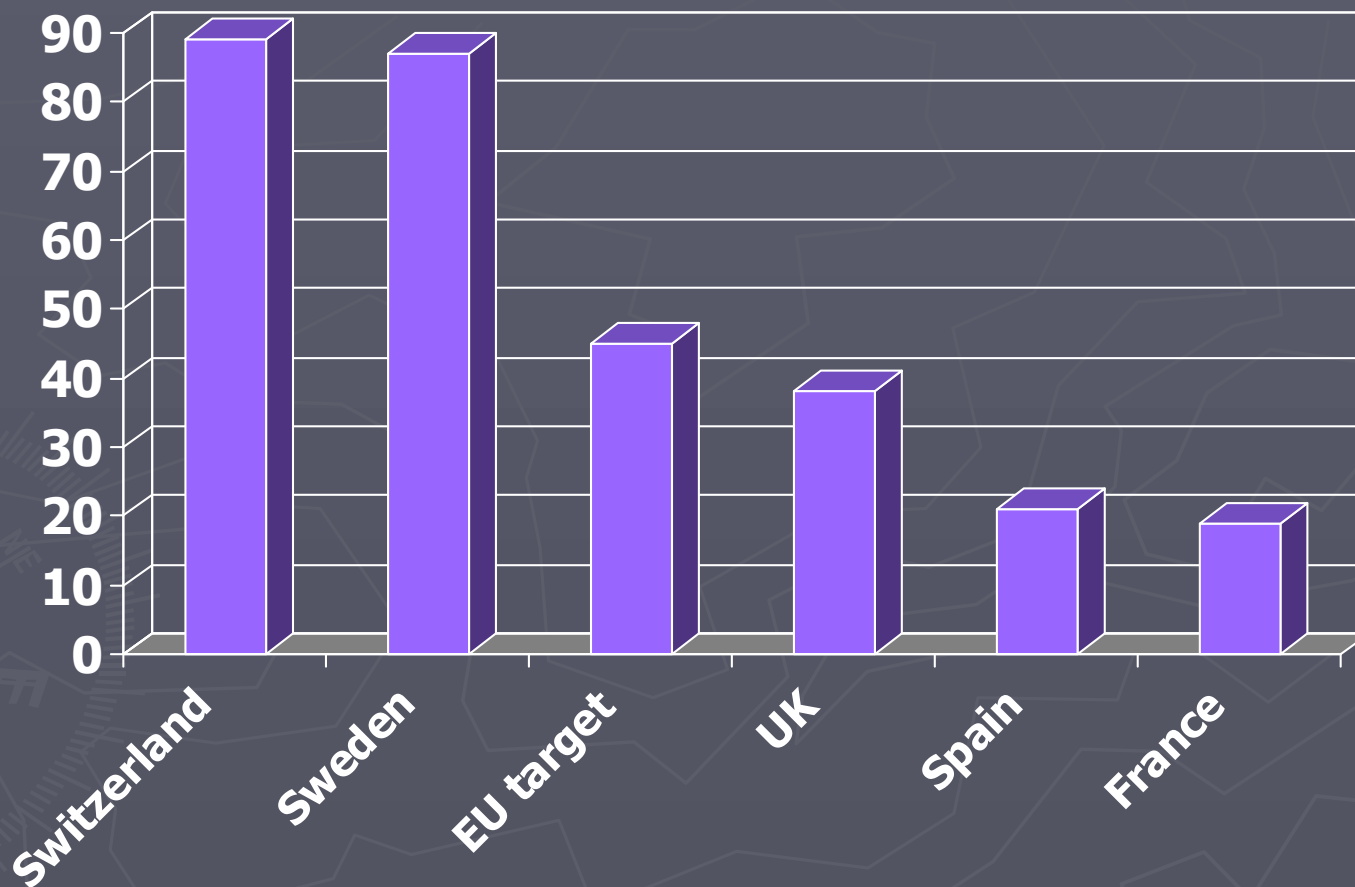
# Energy and recycling

- ▶ Recycling aluminium takes 95% less energy than producing it from bauxite

Electricity needed to produce 1t of aluminium



# Aluminium cans recycling rates (%)



Source: European Commission, 2001