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O 53. RECYCLE ALUMINIUM INDUSTRY IN ALBANIA

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ABSTRACT: Aluminium is an element that has found wide usage due to its mechanical and physical characteristics, such as cars (motor parts, discs, etc.), food packaging, pharmaceuticals, profiles – windows frame, electronics, including the waste from said aluminium part manufacturing. All of these together with other waste aluminium from consumption or manufacturing are separated into post-consumer scrap, also known as waste from aluminium usage, such as cans, cars, profiling, which must be packed and separated before recycling, and pre-consumer scrap, which is generated during the manufacturing process. This kind of scrap can be reinstated into the process to be remelted. The demand for aluminium leads us to recycle this waste and turn them into raw materials for aluminium production. Aluminium scrap is an infinitely recyclable, harmless material and a considerably valuable raw material. The raw material used for secondary aluminium production is scraps, slugs and waste from this industry. The companies that recycle aluminium are mainly small-/medium-sized enterprises; it can be assumed that the statistics for recycling are incomplete.

Keywords*: Waste, Reuse/Recycle, Secondary Aluminium, Scrap.*

INTRODUCTION

Albania is a developing country with a noticeable population growth and an increase of consumption per capita. For this reason, it is developing policies regarding the recycling industry in general and aluminium industries specifically. The total amount of aluminium in Municipal Urban Waste (MUW) is estimated to be about 1.4% of all MUW by mass. The biggest source in the MUW flow is aluminium cans and other packaging, 55% of which are recycled. The aluminium recycling industry in Albania is relatively new (after 2011), and it's undergoing a series of challenges to form as efficient a recycling economy as possible.
It is located in the Tirane-Durres area for logistical reasons, being near the main national port and easily reachable from Kosovo thanks to Administrative Instruction for Export, Import and Transit of Waste of the Kosovo Governement. The aluminium recycling facilities installed in Albania generally use newer (post-1990) technology and follow closed cycles. For example, the majority of air emissions is trapped and circulated within the furnace chimney which allows them to burn completely within the line, also improving energy efficiency. These facilities operate in accordance to ISO 9001 and OSHAS 18001. The recycling unit produces a variety of aluminium alloys in bars or in semisferes. The aluminium scrap recycling process starts with the very important stage of rigorous selection to eliminate undesired components, such as tailing and iron.

MATERIALS AND METHODS

Albanian recycling facilities have 2 main sources of raw material: - local market (60-70% by mass) and - importing (30-40%). On average, during one year, a recycling facility exports roughly 400'000 kg aluminium scraps (17 04 02) and imports about 700'000 kg aluminium wastes. It also generates, on average, 360t of aluminium slag in the same reporting period. This activity is all in accordance to the Basel Convention and the Albanian legal framework. The aluminium content in materials obtained from the local market varies between 92-96% and 96-99% for imports.
The main mark`s produced in recycling lines in Albania are ENAB 46 000, ENAB 47 000, AlSi25, AlMg3.
Mark`s with special advantages intended for the automotive industry are also produced.

Scrap that is processed divided into four major groups:

- Pure waste consisting of only one alloy of steel, iron, lead that may be of one or more alloys.
- Residues with foreign materials such as Fe, Pb, Zn-Al bond may also have one or more alloys.
- Lathes
- Slag

Always when it comes to aluminium scrap the initial operation has to do with pressing the pieces. This of course must be done accurately and in a linear manner. We further classify these wastes into two categories:
- Plates and profiles
- Diffusions (residues with aluminium content)

The former are lightweight and have no foreign materials, but may have aluminium alloys with iron-reinforced plastics. Parts that have iron separated by magnetization. Other impurities such as Pb, Zn, and Sn must be separated by hand. The parts that have iron inside melt at a low temperature of 650°C so that the aluminium passes into a liquid state and the iron passes into the slag channel. However, this process has high costs as it loses a lot of aluminium during oxidation. The obtained materials are pressed and analysed to be ready in the melting furnace. After sorting, the material is fed automatically into a rotary furnace and melted down under salt, in a mixture of sodium chloride to prevent oxidation. When the molten metal is ready to move in to the holding furnaces, it undergoes a corrective treatment including degassing, surface cleaning and filtration.
When it meets the quality specification, the metal is convoyed to the continuous casting plant from which it comes out in the form of bars or sferes
The melting cycles vary between 35-40 calendar days. Throughout a year there are generally up to 4 melting cycles.

RESULTS AND DISCUSSION

The main product obtained from the processing of aluminium waste (aluminium scraps) is the Aluminium Ingot or the main compensating product.
There are no secondary products because even waste classified as:

a) Colatice
b) slag obtained from a product (or aluminum scrap) are recycled during production.

Figure 1. Colatici 85 %

The materials used are specified in DCM No. 99 “For the approval of the Albanian Catalog of Waste Classification ”.
The total installed power is 350 KWh. It is split between almost all machinery in the facility as follows:

a) Funnel – 7 kWh
b) Slag Discharge Baths 7 kWh
c) Homogenizing Furnace 15 kWh

d) Powder opening system (filter) 60 kWh
e) Ingotier 5 kWh
f) Press 40 kWh
g) Selection line 10 kWh
h) Compressors 50 kWh

Figure 2. Soft aluminum Briquettes - 60%

In addition to electricity used for technological line machinery, part of the installed power is used for offices, depending on the required consumption. For example lighting, air conditioning, scales and the whole computer system and monitors. This installed power is about 60 KWh.
The fuels used for the ovens are:
- For rotary furnace Gas, Oxygen and Air.
- For the homogenizing furnace only gas.
For the wastes processed in this technological line, the consumption of gas in kg per kg of raw material varies from 0.1 kg to 0.75 kg of gas per kg of raw material and of oxygen from 0.14 kg to 0.41 kg of oxygen per kg of raw material elaborated.
The utilization coefficient of the main compensating product or commodity (Aluminum Ingots) is calculated for each production cycle as a ratio of the compensating product (Aluminum Ingots) obtained by processing with the quantity of raw material used classified as aluminum scrap or aluminum scrap expressed as a percentage. This coefficient is variable and ranges from 34% to 90%. Products with colatric and slag designations from production, which are recycled (ie put into processing) as a ratio expressed as a percentage between the quantity of these products initially obtained with the raw material introduced into processing ranges from 1.18% to 12%. This is related to the components of aluminum scrap, which dictate features in processing operations in terms of their separation.

Figure 3. Aluminium shreder 70 %

Losses in the production process are the difference left by 100% after deducting the sum of the percentage that the main compensating product occupies with the raw material used. Losses are in direct proportion and conditioned to the utilization coefficient of the main compensating product (Aluminum Ingots). The higher the utilization coefficient of the main compensating product or commodity, the lower the losses and vice versa. It all depends on the percentage of aluminum found in the variety of aluminum slag that society uses as a raw material and the features of the technological process. So the loss is generally determined by these factors:

a) use of the material according to the meaning of its name - aluminum scrap or scrap,
b) losses created by metal oxides due to the technological process at high furnace temperatures,
c) from the burning of paints with which Iyer wastes, plastic parts found in scrap, inerts or other contaminants, lubricating oils located in the aluminum parts of vehicles, etc.

After the melting process the losses, i.e. the ratio of the raw material and the obtained product, are 15-22% for Albanian scraps and 5-9% for imported ones.

The norm of use of the main compensating product or commodity (Aluminum Ingots) is calculated for each production cycle as a ratio of the compensating product {Aluminum Ingots) obtained from the processing with the quantity of raw material used qualified aluminum scrap or aluminum scrap expressed in aluminum . This normative is variable and ranges from up to 90% by weight.

The formula for its calculation is expressed as follows:

$$losses\ \% = \frac{scrap\ quantity - alloy\ quantity}{scrap\ quantity} * 100$$

Working hours for the preparation of the finished product are 7-12 hours depending on the quality of the scrap that goes to the foundry. During the control of the consumption of raw materials which are mainly: (Motor parts, discs, etc.), food packaging mainly cans, lathes, waste resulting from the work of various aluminum accessories, durals, etc. notice losses and sales during the smelting process of various aluminum scarring games which were influenced by these factors:

a) use of the material according to the meaning of its name - aluminum scrap or scrap
b) losses created by metal oxides due to the technological process at high furnace temperatures,
c) losses created due to evaporation, release in the form of gas
d) from the burning of paints with which the waste is painted, plastic parts are found joined in scrap, inert or other contaminants, lubricating oils are located in the aluminum parts of vehicles, etc.,

Based on these parameters, the rate of losses in the processing of aluminum scrap presented in the table below was calculated.

Table 1. Lost mass during processing

No	Product Category (Scrap)	Lost mass percentage during processing
1	Briquetted soft aluminum 60 %	40 %
2	Strong aluminium 75 %	25 %
3	Shreder Aluminiumi 70 %	30 %
4	Colatice 85 %	25 %
5	Difuzione 90 %	10 %
6	Automobile discs 75 %	25 %
7	Strong profile 75 %	25 %
8	Profile 65 %	35 %
9	Canned Briquettes 50 %	50 %
10	Aluminium foil 45 %	55 %
11	Slag 30 %	70 %
12	Slag 40 %	60 %
13	Slag 45 %	55 %
14	Aluminim taps	80 %
15	Lathes 55 %	45 %
16	Lathes 60 %	40 %

For the producing 1 tonne of aluminium ingots in one of the recycling unit in Albania need

Table 2. Quantity for production

No.	Category	Consumption (kg)
1.	Scraps	1794
2.	Salts	800
3.	Oxygen	300
4.	Gas (LPG)	280
5.	Silica	48
6.	Electricity (not in the process)	240

The impact from aluminium recycling facilities is local, measurable and controllable via contemporary techniques:

Table 3. Environment impact

Process	Raw material	Air emissions	Process wastes	Other wastes
Bauxite processing	Bauxite, caustic soda	Particles (Pm)	-	Excess contain Si, Fe, Ti
Purification of alumina (Al_2O_3) and precipitation	Aluminum sludge (Al_2O_3), aluminum powder and water	-	Aqueous wastes contain aluminum powders, sand and abrasives	-
Calcification of alumina	aluminum hydrate (Al)OH_3	Particles and vapours	-	-
Melting of secondary aluminum scrap	Aluminum scrap, oils and gases, chlorine or other additives $AlCl_3$, AlF_3, KCl, Na and fluorure	Particles and HCl/Cl_2	-	Sludges contain magnezium Mg and chlor Cl
Recycling of secondary aluminum slag	Aluminum slag water	Particles (Pm)	Aqueous wastes, salts	-

CONCLUSIONS

The consequences of aluminium scrap recycling include:

- Economical profits
- More stable environment
- Social wellbeing
- All the water used is recycled, purified and cooled in special plant to prevent the problem of waste water disposal.
- The flue gas purification plant is monitored continually and undergoes routine maintenance. The emissions from the smelting furnaces are analysed regularly to ensure that they comply with the applicable regulations.

Figure 4. Aluminium ingots

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