Feasibility of Manufacturing AirSlip quality Billets From Extrusion Scrap

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Analysis

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Preamble
Currently India produces annually around 800,000 tonnes of Aluminium in Primary Smelters located at Angul, Hirakund, Korba, Renukoot and Salem.

This is expected to rise to ~ 1,200,000 tonnes in 2006 and over 1,500,000 tonnes by 2010 by way of expansion of existing Smelters and setting up of new Smelters.

In addition between 1,000,000 to 2,000,000 tonnes of aluminium are processed in the Secondary Aluminium Industry.

The Secondary Aluminium Industry includes:
- Extrusion Units
- Conductor Units
- Die-Casting Units
- Foil Plants
- Secondary A lloy Units including De-oxidising A gents Producers
  - A Aluminium U tensils / Pressure Cookers Producers
  - A Aluminium Wheel Plants etc

Indian Extrusion Industry
Current Installed Capacity of Indian Aluminium Extrusion Industry approximates 250,000 TPA in the organized sector with perhaps similar capacity in widely spread un-organised sector.

This is expected to rise substantially considering up-gradation of existing units as well as new units under implementation.

Major players in the organized industry include following primary producers:
- Hindalco
- Indal - now part of Hindalco
- Balco - now part of Sterlite Group
  As well as:
  - Jindals
  - Mahavir
  - Pennar
  - Century
  - Pankaj
  - Sudarshan
  - Narmada
  - etc

Un-organised Sector widely spread across the country caters to local demand of extrusion at lower end of the market.

Present Status
Over the years the Author has visited facilities at most of the plants mentioned in para1.

It has been observed that whereas in some of the units - specially Primary Industry - quality of the end product i.e. extrusions is excellent, in many units quality of the end product does not conform to International Standards.

With free market economy now prevailing in our country imported extruded products are freely available. Hence unless Indian Extrusion Industry undertakes technological up-gradation, in the foreseeable future specially those in the unorganized sector may be completely wiped out of the market by availability of cheaper superior quality imported products.

Billets - Feed Stock for Extrusion Industry.
Primary Producers e.g. Hindalco, Balco, Indal, Nalco produce in-house billets from hot-metal from Pot Lines.
Hindalco & Nalco have modern Hot Top Billet Casting Stations to produce Billets to International Standards. Primary Producers have modern quality control facilities to ensure good quality of billets.

Secondary Units either cast their own billets from in-house scrap / aluminium pigs (ingots) or purchase Billets from Primary Producers / import the same.

**Quality of Billets for Extrusions is dependent on:**
- metal quality e.g. hydrogen level, extent of non-metallic inclusions
- casting technology
- homogenizing

**Typical Extrusion Unit in the Secondary Sector:**
- Melting / Holding Furnaces
- Degassing Facilities for reduction of non-metallic inclusions and hydrogen content
- Ceramic Foam Filter
- Casting Station with Billet Tooling
- Billet Stripping & Inspection
- Billet Homogenising Furnace
- Extrusion Press
- Aging Furnace

*These are mostly non-existing in large number of existing Extrusion Plants.

**Survival of Extrusion Units in the Secondary Sector**
- availability of high quality billets (AirSlip) from Primary Producers / imports
- In-house production of AirSlip quality billets

**Air Slip Billets Production Facilities**
A case study was carried out in an existing Unit for upgradation of Cast House Technology and setting up of AirSlip quality billet production of 15,000 tonnes per year.

Based on working 24 hours a day, 7 days a week and 25 days a month (balance 5 days for holidays / maintenance and unforeseen), it was planned to set up new facilities capable of producing 5.6 MT per day of AirSlip Billets in 2 sizes:

- 50% - 152 mm diam. X 6,300 mm long
- 50% - 178 mm diam. X 6,300 mm long

Total Project Cost is estimated at: US$ 3,000,000.

This includes broadly following Major Equipment + Contingencies + Cost of Funds during construction:

1. 25 Ton Nirvan-Gautschi Stationary Melting Furnace
2. 2 Nos. 12 Ton Nirvan-Gautschi Tilting Holding Furnaces
3. 1 No. Degasser
4. 1 No. Nirvan Filter Box
5. 1 Set RexMaterials Launder System
6. 1 No. Wagstaff Casting Machine with Automation & AirSlip Tooling System
7. 1 No. Billet Stripping / Storage / Inspection Station
8. 1 No. Nirvan-Gautschi Billet Homogenising Furnace

Typical Arrangement of Major Equipment is shown on Page 4.

In addition Centralised Testing Laboratory is necessary to test and ensure correct physical / chemical / metallurgical properties of incoming feed stock as well as intermediate products and final product.

**25 Ton Nirvan-Gautschi Stationary Melting Furnace**
25 Ton Stationary Melting Furnace lined with non-wetting refractories is rated for melting rate of 4 tonnes per hour.

The Melting Furnace is designed to have an optimum Combustion System & PLC based Control System to ensure highly efficient operation.

Once every 8-hours shift molten metal ~ 23 tonnes can be charged to 2 Nos. Nirvan-Gautschi 12 Ton Tilting Furnaces to obtain 4 drops each of 5,600 kgs.

**2 Nos. 12 Ton Nirvan-Gautschi Tilting Holding Furnaces**
12 Ton Tilting Holding Furnaces shall be designed for adjusting alloy composition as well as heating the hot metal by up to 100 deg. C to take care of subsequent temperature losses in Degasser as well as Filter Box and associated Launderers.

Each Tilting Furnace will have adequate metal for 2
drops / shift.

Design Capacity: 12 drops per day from 2 Nos. Holding Furnaces.

Required: 10 Drops per day

Degasser:
Degassers ensure reduction in hydrogen level of the hot metal to ~ 15 ppm. In addition by adding chlorine < 0.5 % of process gas nonmetallic inclusions separate from aluminium and get attached to the rising bubbles and float to the surface.

Chlorine forms salts with dissolved alkali metals. The salts float to the surface. Nonmetallic inclusions and salts then can be removed by skimming.

The Degasser is rated for metal flow rate of 8 000 kgs per hour.

Ceramic Foam Filter Box:
Ceramic Foam Filter Box is designed for maximum metal flow rate of 8 000 kgs per hour.

RexMateri als Launder System:
This ensures low temperature loss in launders - less than 1 degree C per meter length- specially during beginning of every casting cycle.

AirSlip Casting Station:
It is proposed to set up Wagstaff Maxicast Hot Top Billet Casting System with Wagstaff AirSlip Air Casting Process with 16 Strands Table. It will cast:

- 13 strands of 178 mm diam. Billets and
- 16 strands of 152 mm diam. Billets

Casting time:
-178 mm diam Billets ~ 50 minutes and for
-152 mm diam. Billets ~ 41 minutes

Metal Flow Rate: 5 600 kgs in 41 minutes i.e. ~ 8000 kgs / hour

Cycle Timings:
Wagstaff Casting Station:
This usually determines sizing of the other equipment. Wagstaff Casting Machine has been sized as follows:

- Finished billet weight: 15 000 tonnes per year = 1250 tonnes per month i.e. 50 tonnes per day (25 days / month)
- Cast weight: 56 tonnes per day (90 % pit recovery including saw crop)
- Drop weight: 5 600 kgs

Holding Furnace:
Tap-to-tap time: 3 hours

- charging time.........................0.5 hours
- Alloy composition adjustment + metal reheat by 50 to 100 deg C: 1.5 hours
- Wagstaff Casting Station:
  - 152 mm Billets ..............0.70 hours
  - 178 mm Billets............0.85 hours

Total daily production capacity of 56 tonnes will be achieved with 10 drops per day. Designed Facilities are capable of 12 drops every day. Hence all the equipment would operate at optimum level.

Cost of Operation:
Interest on Long Term Loan @ 6 % US$ 180 000
Depreciation @ 10 % (Straight Line Method-10 years) US$ 300 000
Consumables @ US$ 2.5 / to US$ 37 500
Maintenance @ 2 % of US$ 3 000 000 US$ 60 000
Operation Personnel (6 per shift) US$ 120 000
Utilities (Fuel: US$ 918 000 + Power: US$ 187 000)
Total Fuel Oil Consumption / tonne
(Melting/Holding)... 85 kgs
Power Consumption / tonne (Melting/Holding)....
50 kwh
....do.../tonne...(Casting Machine + Hydraulics + Water Pump)
....do.../tonne...(Homogenising Furnace) 10 kwh
Fuel Oil Consumption / tonne (Homogenising Operation)
40 kgs
Fuel Cost --------------------- Rs. 22 / kg
Power Cost --------------------- Rs. 4 / kwh

*Utilities:
Fuel:
Melting/Holding Furnaces: 85 kgs per tonne @ Rs. 22 / kg = Rs. 1870 per tonne
1870 X 15 000 = Rs. 28 millions = US$ 625 000
Homogenising Furnace: 40 kgs per tonne @ Rs. 22 / kg = Rs. 880 per tonne
880 X 15000 = Rs. 13.2 millions = US$ 293 000

Power:
Melting/Holding Furnaces: 50 kwh
Casting Machine: 80 kwh
Homogenising Furnace: 10 kwh
Total: 140 kwh X Rs. 4 = Rs. 560 X 15 000 = Rs. 8.4 millions = US$ 187 000
Annual Cost of Utilities: US$ 625 000 + US$ 293 000
+ US$ 187 000 = US$ 1 105 000

Notes:
a) More exact calculations can be made at Detailed Feasibility Stage.
b) In international market AirSlip Billets command premium varying from US$ 220
to US$ 240 per tonne.
c) All costs are shown in US$ to facilitate Export oriented Project.
d) It would be worthwhile to set up facility for 20 000 tonnes per annum to reduce pay-back period as well to have provision for export of 5 000 tonnes AirSlip billets per annum. That would qualify the Project for Zero Import Duty Imports.
e) It is learnt from an extruder in India that they have
paid up to Rs. 9,000 per tonne more for Hindalco produced AirSlip quality Billets compared to Hot Top Billets available from Nalco.

**Additional Advantages of AirSlip quality Billets:**

- Expected additional production from Extrusion Press with AirSlip Billets: 10% i.e. 1,500 tonnes per year.
- Projected extra realisation from Extrusion at 5% i.e. US$ 110 per tonne
  - Additional realisation: 1,500 X 110 = US$ 165,000
  - At this cast house it was noted that introduction of AirSlip Technology will bring out following benefits:
  - Pit House Recovery: Currently 92 to 93% is expected to rise to 98.99%.
  - Saw Recovery: Currently 90 to 92% is expected to rise to 95%.
  - Press Recovery: Currently 78% is expected to rise to 88%.
  - Overall Recovery improvement is expected at 12%.

**Conclusions:**

With growing building industry, white goods industry, transport industry including two wheelers, four wheelers as well as luxury coaches and progressively higher use of aluminium by railways, there will be higher demand for quality extruded products.

It is hoped that Indian Extrusion Units will take advantage of expanding market and rise to the occasion and meet local demand and also succeed in capturing export market.

Prime Facie Proposal to set up Scrap based Facilities for production of AirSlip quality billets suitable for extrusion at high speed and high yields is indeed a viable one.

A adoption of modern technology can reduce cost of production, improve recoveries and ensure survival in ever changing market oriented economy.