

Aerospace Application Plates and Sheets in India – contribution by BALCO

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Bharat Aluminium Company (BALCO), a member of Vedanta Resources Plc., a listed group in the London Stock Exchange is a fully integrated producer of primary aluminium ingots, wire rods and aluminium Rolled products. During the last 3 decades BALCO has been actively engaged in providing sustenance to vital industries in the electrical, transport, packaging, consumer durables, architectural, Defence and Aerospace sectors and has proved its mettle by developing and supplying special aluminium alloys to the Intermediate Range Ballistic Missile 'Agni' and surface Missile 'Prithvi'.

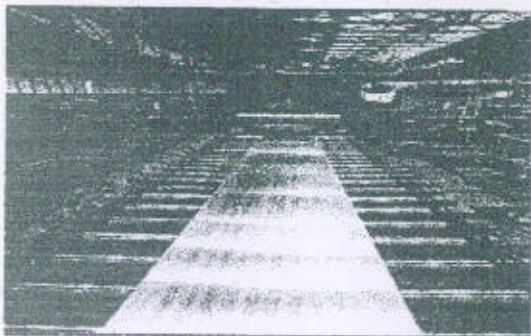
Facilities available at BALCO for manufacturing of aerospace grade alloys:

Balco has played a pivotal role in indigenization of various aluminium alloys required for Aerospace and Defence applications.

The facilities Balco had before initiating the joint venture of source indigenization for the Launch Vehicle Programmes of VSSC are given below:

Production facilities:

1. **Casting Units** - Melting furnaces with precision temperature controls.
 - On-line SNIF degassing.
 - Ceramic foam filter.
 - 15-degree tilted super caster (18000MT/A).
2. **Hot Rolling Mill** - The only 4 high Hot Rolling Mill in India (75000MT/A)
 - The Mill can roll slabs up to 1620 mm wide.
 - Contains Edger to minimize edge cracking.



Hot Rolling Mill

3. **Old Cold Rolling mill** – Sturdy 4 high Mill from Russia (30,000MT/A).

- Hydraulic Automatic Gauge Control.
- Configuration helps to minimize shape variation.

4. **New Cold Rolling mill** - Hydraulic Automatic Gauge Control.

- Shape and Flatness Control.
- Capacity of 36,000 MT/A.

5. **Hard Sheet Treatment Line.** -Semi Continuous Solutionizing Drop Bottom Furnace.

- 250 T Sheet Stretcher with online end shear.
- Automated Sheet Handling System.

Quality Assurance Laboratory and Fabrication Pilot Plant for development of sophisticated alloys for Defence and other strategic sectors:

Balco has a well equipped Quality Assurance Laboratory and Fabrication Pilot Plant, set up with the funding of Department of Science & Technology, for development of high strength alloys for Defence, Aerospace and other critical applications.

Facilities available after the 1st Phase of VSSC Project, jointly taken up for indigenizing of Aerospace grade aluminium sheets and plates:

1. Solution treatment Furnace.
2. Skin Pass Rolling Mill and roller leveller.
3. Plate Stretcher.
4. Ageing Furnace.
5. Ultrasonic Testing Machine.
6. Preheating pusher Furnace
7. Polishing Machine.
8. Sawing Machine.
9. Material Handling System.
10. Cut To Length Machine.

Products successfully supplied to ISRO for Space applications:

1. Alclad AA 2014 T4/T6 temper sheets.
2. AA 2014 F temper plates.
3. AA 2219 F temper plates.
4. AA 6061 T6 temper sheets.
5. AA 7075 F plates.

Facilities which would be available after 6 months:

As a backward integration measure, establishment of casting facilities for producing aerospace quality slabs and billets has been jointly taken up with VSSC. This would make Balco an independent source of quality aerospace materials. Thus Balco would be able to

Since the start of the application, CGM has been proving quite beneficial for BALCO precipitation circuit. The desired result of hydrate coarsening, liquor productivity and overall circuit control are being successfully attained, and the CGM dosage has been optimised to a fair extent.

Apart from a good control on hydrate granulometry, CGM has helped in reducing the hydrate attrition by about 8-9%. The latter has led to improved operations in the smelter area.

The CGM programme has proved to be a good process control tool for BALCO precipitation circuit.

RESULTS & DISCUSSIONS

The $-45\mu\text{m}$ size of product alumina before and after the CGM addition are graphically shown in Fig-1. It can be seen from Fig-1 that fines were in the range of 35-40% before addition of CGM. It shows the fines are in the range of 20-25% after addition of CGM and stabilization of the circuit. Fig-2 shows the improvement brought about in the liquor productivity during the above mention period. Furthermore, it was observed that with introduction of CGM in precipitation circuit the coarser portion of hydrate slurry also increased which in turn resulted in improved classification efficiency in the hydro cyclones. Now crystal growth modifier is being used for fine-tuning of granulometry. The amount of variation in granulometry has been brought down to a very narrow margin. Further control is being exercised by controlling the addition of CGM as per the $-20\mu\text{m}$ level in the seed.

The various parameters, which are being controlled, are as follows :

1. The fill temperature.
2. Solid concentration (gpl) in the first and last precipitators.
3. Seed granulometry with special emphasis on $-20\mu\text{m}$ fraction.
4. CGM dosage.
5. End temperature.

CONCLUSION

It is our endeavour to consolidate the gains achieved through the usage of CGM and to optimize further on the precipitation parameters to strike a proper balance between the product quality and plant productivity. This will help us in striking a proper balance between the product quality and plant productivity. Though significant gains have been achieved in meeting the customer demand still fine turning and optimization of the process parameters is underway by the dedicated and young team of professionals.

Fig. 1 Fines as -45 microns, %

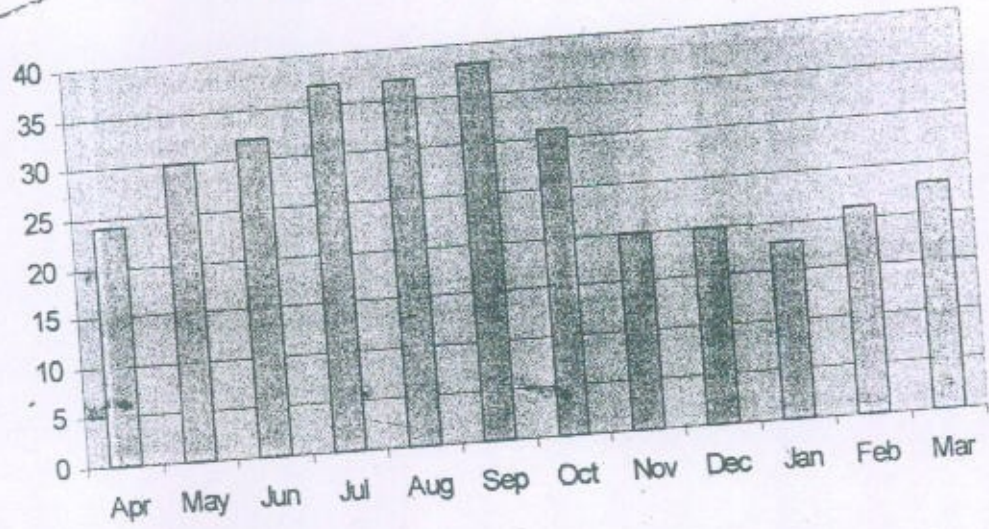
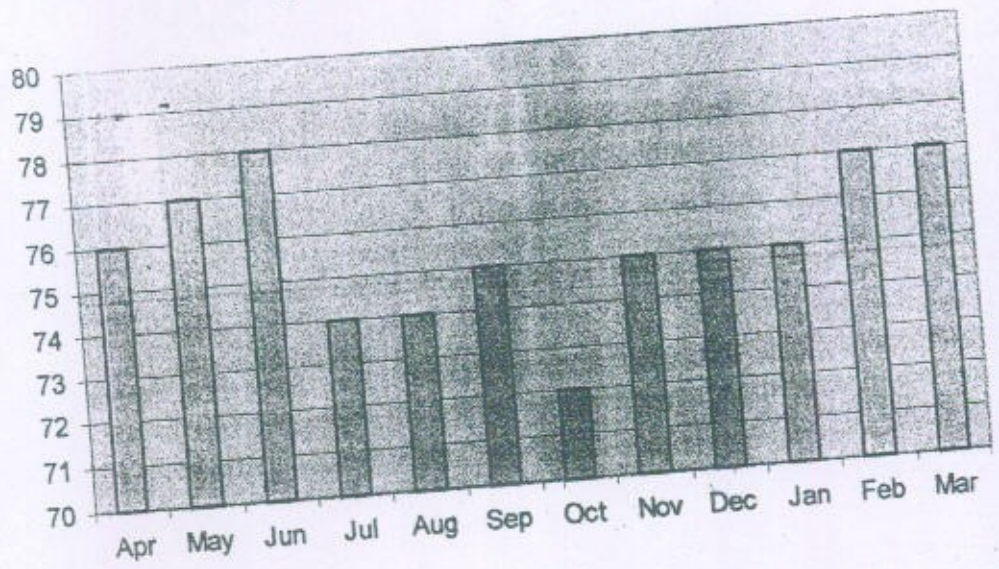


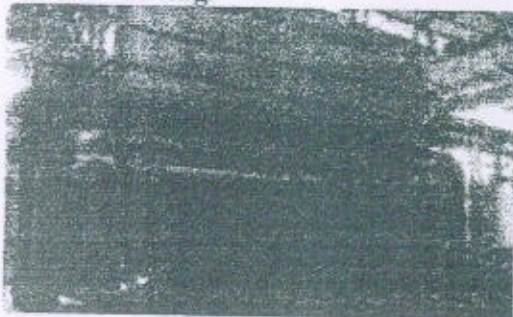
Fig. 2 :Liquor Productivity, gpl



cater to the needs of not only aerospace but would be in a position to supply high strength alloys, having stringent quality requirements, for various critical applications.

The facilities which are being set up in the 2nd phase of VSSC Project are as follows:

1. Melting cum Refining furnace.
2. IRMA (In furnace gas injection).
3. ALPUR degassing system.
4. In-line Ceramic Foam Filter Unit.
5. Metal transfer system.
6. Cooling water system.
7. DC Casting Machine.
8. Billet tooling: 400 – 820mm dia billets.
9. Slab tooling.
10. Casting machine automation package.
- 11 Slab sawing.
12. Billet sawing.



Solution treatment furnace

Additional output Quality & Capacity after 6 months:

- Ultrasonic Class A as per AMS 26300 B.
- Inclusions - < 0.01 mm²/kg for slabs
- < 0.02 mm²/kg for billets
- Hydrogen level-Below 0.1 cc/100 gm of Al
- Controlled fine Grain size
- Controlled Pore size
- Alkali metal - < 2 ppm
- Capacity-20,000 MT per annum

Manufacturing of aerospace quality plates and sheets of aluminium alloys requires very stringent quality control measures. BALCO has contributed significantly in the endeavor of VSSC to indigenize the sourcing of the aluminium plates and sheets required for their Geo Stationary Launch Vehicle (GSLV) Programmes. By close monitoring right from the casting stage to the finishing line BALCO ensures production of superior quality, cost efficient plates and sheets for aerospace applications.