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TECHNICAL LECTURE SERIES

Low Amperage Pot operation For Unplanned or Planned problems in power availability

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Reasons for low amperage.

COAL SHORTAGE.

PROBLEMS IN POWER GENERATION.

WATER AVAILABILITY IN POWER PLANT.

ASH DISPOSAL.

ANODE OR ALUMINA AVAILABILITY – RARE

Case study

Amperage reduction up to 160 ka in an AP-18 pot operating at 182 ka.

Normal operation

AP 18 pots

182 to 183 ka.

Pot Voltage: 4.15V

Graphitized bottom block cathodes.

Semi graphite side blocks

Current efficiency 93.5 to 94.5 %.

Production :1385 kgpd

Excess AlF3: 11.5%

Bath Temperature: 955 to 960 Deg.C

Anode changing shift cycle -68/72 shifts.

Instability-0.16 micro Ohms

Normal operation – continuation

Gas evacuation from each pot : 1.6NM^3/sec.

Number of alumina feeding shots of one kg each: 2600- 2700 in 24 hours..

Number of alumina feeders: 4

Normal alumina feeding interval: 170 seconds.

Fast feeding interval : 100 seconds.

Metal inventory maintained: 11-12 mt. Metal height-20 cm

Bath inventory maintained : 8-9 mt. Bath height-17 cm

Aim to keep alumina concentration.1.5-2.0%

ACD: 4.5 cm approximately.

Effects on the pot when the input power reduces.

Thermal balance is affected:

- **Heat Input reduces drastically – meaning freezing of liquid bath.**

Extension of side ledge

Increase in instability or noise.

Alumina solubility decreases.

Increase in bath resistance due to Bath getting colder & chemistry disturbed

Cathode getting colder and resistance increases.

Anode gets colder and drop increases

Increase in metal level.

Feeder Holes getting choked.

May lead to increase in Anode effect

Risk of Anode surface leaving the contact with bath – open circuit.

Effects – Manifestation.

Cathode resistance increases

Anode resistance increases

Bath resistance increases.

Pot Temperatutre reduces.

All these enhanced drops, need to be compensated by way of increase in Anode Cathode Distance

How to Tackle this?

Aim should be to retain as much heat as possible.

Immediate actions:

1. Suspend anode changing operation. Anode changing operations takes away lot of heat from the pot by way of hot butt removal, bath skimming and new cold anode installation.
2. Carryout anode covering and anode dressing activities.
3. Stop at least one exhaust fan at FTP.
4. Increase the set point resistance to such a level to get the pot voltage more than 4.0 V.
5. temporarily stop alumina feeders
6. Increase the alumina feeding durations, both normal as well as fast feeding.
7. Suspend AlF_3 charging.
8. Start extra metal tapping from pots.

How to tackle? – continuation: Further actions

1. Taking bath height and identifying low bath pots. Take appropriate action .
2. Normally alumina is mixed with crushed bath for anode cover. Around 30% alumina mix is used. Reduce this to 10%.
3. **Change excess Alf3 target to 10% (reduce from 11.5%)**
4. Increase bath temperature measurements. Take corrective action on low temperature pots.
5. Let pot regulation continue in a normal manner.

Anode changing shift cycle.

Under normal circumstances the anode consumption is 0.5cm per shift. Total height of the anode being 550cm, after 68 shift cycle consumed was 34 cm and the butt height was around 20 cm. This was the reference to achieve.

Initially tried 76 shift cycle, the butt height was 22cm.

Hence switched to 80 shift cycle, the butt height reached 19-20 cm.

So we settled at 80 anode changing shift cycle for 160 ka operation.

Slotted anodes were discontinued.

Alumina Feeding

01

Calculate the alumina requirement at 94% current efficiency and at 160 ka.

- Will produce 1212 kg per pot day and requires 2327 kg of alumina.
- That means 2327 shots of 1 kg shots.

02

Accordingly adjust the normal and fast feeding intervals.

03

Allow the pot regulation to do the rest.

Target Excess AlF_3

- **Normally we used to operate at 11.5% .**
- **We switched to 10% target, which helped to maintain bath level.**
- **Additions of AlF_3 was managed accordingly.**

Extra Metal Tapping

- **In order to retain the heat , the metal inventory needs to be brought down.**
- **Lower the metal height lower is the heat dissipation.**
- **From the original level of 20 cm, tap metal to bring it down to 17/18 cm till we are reaching the target bath temperature of 950^{0}C plus.**

Period required for stabilization

- **By carrying all the above detailed activities simultaneously, it took around 12-15 shifts to gain stability.**
- **Later on, close monitoring allowed us to continue for months of low amperage operation is a very stable manner.**
- **Parameters achieved:**
  - **Current efficiency of 95%,**
  - **pots were rock stable with instability lesser than 0.15 micro ohms,**
  - **metal Purity maintained**
  - **DC Energy consumption reduced by 10%**
  - **Literally no anode care was required.**

On Getting information about power availability:

Strategy to restore original operating amperage.

Amperage stepping up strategy

- Increase 2-3 ka at a time and wait for at least 4 shifts for next increase. Watch bath temperature and bath level.
- Allow metal to build up . (Tap lesser metal or skip metal tapping so that in due course the original metal inventory & level may be achieved)
- Adjust the set point resistance to maintain the pot voltage at around 4.10 V and gradually to 4.15 V.
- May take 12-16 shifts to stabilize.
- Adjust the alumina feeding as per amperage and slopes.

Amperage stepping up strategy - continuation

- Gradually reduce anode changing shift cycle as per amperage step up gradient. (Every 5 ka increase reduce the cycle by 4 shifts)
- Gradually increase the target AlF_3 , in steps of 0.5% at an interval of 4 shifts, to reach the original target of 11.5%.
- At a appropriate juncture based on bath temperature and bath levels increase gas suction by operating the exhaust fan which was stopped earlier.
- In about ten days time we may be able to reach all the original amperage and operations.
- Restore alumina mix in the crushed bath to 30%

Successful tackling of Low Amperage problem:

With all the aforesaid procedure & methodology ,

“We COULD SUCESSFULLY TACKLE THE LOW AMPERAGE SITUATION AND ALSO LAY DOWN A WELL DOCUMENTED PROCEDURE FOR FUTURE OCCURRENCES ALSO”

Amperage lesser than 160 ka.

Any amperage lesser than 160 ka found to be disastrous. At 150 ka , the bath shrinkage was very rapid from the third day onwards. Hence considered unsafe.

Decisions taken

Not to operate lesser than 160 ka.

To import power to an extent to maintain 170 ka.

Future technology:

Both AP and GAMI are carrying out research for incorporating a suitable program in pot regulation system to tackle 10-12% reduction or fluctuation in amperage.

All the actions described during the course of this presentation will be incorporated in the regulation program.

Thank You