

Brief write-up on S&T (Mines) completed projects

Project Title: Effect of modified seed properties in precipitation of aluminium hydroxide from Bayer liquor (S-23).

File no: 14/41/2016-Met.IV

Objective:

- New process and product development in precipitation
- Explore the possibility of using modified seed hydrate to enhance the yield.
- To reduce the energy consumption by establishing parameters to produce gibbsite / boehmite alumina hydrate
- Study kinetics/ mechanism of precipitation with respect to seed surface property by using thermally activated seed (TAS)
- Comparison of precipitation kinetics with TAS and conventional seed

Background:

Special grade hydrate is presently produced by grinding and thermally activating conventional alumina hydrate. Gibbsite alumina hydrate is being used in calcination. R&D work was undertaken by JNARDDC to modify the properties of aluminium hydroxide seed hydrate with a view to enhance yield of gibbsite / boehmite alumina hydrate with reduced energy consumption. The project also aimed at improving liquor productivity, formation of new products and development of new process.

Outcome:

❖ Development of following processes:

- Precipitation process using mechanically activated seed to produce fine alumina hydrate. Presently produced by grinding of conventional seed hydrate
- Precipitation process for producing coarse and fine high surface area alumina hydrate
- Precipitation process using boehmite seed to produce boehmite alumina hydrate
- Calcination (parameters) of boehmite hydrate to produce smelter- grade alumina
- Process for producing coarse and fine high surface area gamma alumina

❖ Developed the following products using precipitation route:

- Fine hydrate (d_{50} : 10-12 microns)
- Coarse (d_{50} : 90-100 microns) and fine size (d_{50} : 10-12 microns) activated alumina having high specific surface area (150-350 m^2/g)
- Coarse (d_{50} : 90-100 microns) and fine (d_{50} : 10-12 microns) boehmite hydrate
- Coarse (d_{50} : 90-100 microns) and fine size (d_{50} : 10-12 microns) gamma alumina having high surface area (80-105 m^2/g)

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- ❖ **Smelter grade alumina from boehmite hydrate**
- ❖ **In an existing plant, the mechanically/ thermally activated seed or boehmite seed can be used in few of the precipitators, parallel to the conventional seed precipitators to obtain special product which will have high commercial value as a hydrate or may be partially calcined to obtain high-value product.**
- ❖ **Alumina with specific surface area in the range of 60 m²/g to 70 m²/g, 94 % particles above +45micron size, and loss on ignition (LOI) <1% in the temperature range 300-1000°C using boehmite hydrate was achieved at a calcination temperature of 650-700°C as compared to present calcination temperature of 1000-1100°C. **This will reduce about 50% energy in calcination.****
- ❖ **Based on the encouraging lab scale results for boehmite precipitation and calcination studies, the next phase of R&D project needs to be undertaken with the support of the Govt. and alumina refinery to scale up the process to bench scale level.**
- ❖ **The research paper publication received the 2nd best award in the 7th International Bauxite, Alumina and Aluminium Conference and Exhibition 'IBAAS- 2018' held at Mumbai, 5-7 September, 2018**
- ❖ **Patent filed** for "A process for preparing smelter grade alumina" vide No.201821049247 dt 27.12.2018.
- ❖ **Poster presentation in INCAL-2019.**
- ❖ **Research paper published in *Journal of Sustainable Metallurgy*.**