Redefining 'scale of economy' for stand-alone specialty alumina production capacities

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Abstract

An overwhelming share of global calcined alumina production is earmarked for aluminium smelting. The remaining 10 % or less goes into the production of a wide range of value-added specialty alumina products. The CAPEX and OPEX of primary alumina producing refineries have been rising rapidly in recent years. This has led to the scale of economy of such production facilities going up in recent years from 100 000 tons per line to multi million tpa (tones per annum) levels. Of late, it is becoming increasingly difficult for primary alumina producers to divert their 'expensive' production capacities from supporting smelter requirements to producing high value low volume customized specialty aluminas. At the same time, the global demand for industrial and consumer durable end use products for various grades of specialty aluminas has been going up. In fact, wider utilization of specialty aluminas and the expansion of their markets is being throttled by the right products not being available at the right time, at the right place and in right volumes. This paper looks at shifting values on criteria that have been traditionally considered for defining 'Scale of Economy' for setting up of Smelter grade Alumina production facilities. It takes a look at the impact it has had on the viability of setting up of standalone merchant and/or captive 'Specialty Alumina' production facilities in the small and medium sector.

Keywords: Specialty Alumina; scale of economy; Capex; Opex; Supply Chain and Product mix management.

1. Introduction

For over a century, Bauxite ore and Bayer process have remained the singular source and production technology for producing smelter grade alumina. The world currently has an annual Alumina refining capacity of 108 Mt and during 2014 this had supported a global primary aluminium production of around 53 Mt. [2, 10]

Of the overall output of global alumina refining capacity, 90-95 % has gone to meet the needs of aluminium smelting. The remaining 6 to 8 million tons were converted into 'Special Grades of Alumina' [2]. During the past couple of decades, eight major specialty grade alumina producers have also come up with a conversion capacity of 2.5 to 3 Mt with feedstock of alumina hydrate and calcined alumina being provided by the primary calcined alumina producers. The balance of supply sources are mostly covered by primary producers themselves and small-scale convertors of low volume high value end product producers. Thus, the cost, pricing and profitability structure of specialty alumina industry remains more tied to that of the primary calcined alumina producers than with its own market technical fundamentals.

In the recent times, few older refineries have had their process and operating systems re-designed to produce Special Grades of Alumina. An exception being, the Mempaw 300 000 tpa Chemical Grade Alumina plant of PTA ANTAM in West Kalimantan, Indonesia which due to commence its commissioning in 2014 [3].

2. Product classification

Specialty Aluminas are broadly classified into two categories.

1. Chemical Grades - Microfine low soda hydrates, Aluminium sulphate, Chlorides, Sodium aluminates, Zeolite, Aluminium fluorides, Fire retardants etc.
2. Calcined grades- Refractory, Abrasive, Ceramic, fused alumina, calcined aluminate cements, Synthetic jewels etc.

In terms of market share by volume, the major application area segment distribution is of the order of

1: Refractories……. 60 – 65 %
2: Ceramics……... 20 – 25 %
3: Abrasives…….. 10 – 15 %
4: Others…… 5 – 10 % [7].

The ceramic grades cover a wide range of products, which feed the global Refractory manufacturing industries. The broad categories of refractory input material that Specialty Alumina Industries service are:[10]

1. Tabular Alumina
2. High alpha calcined alumina
3 Reactive alumina
4 Calcined aluminate cements
5. Various grades of spinels
6. Brown sintered alumina
7. Alumina bonding agents

While all metallurgical industries (e.g. iron and steel making, ferrous and non-ferrous foundries, aluminium, copper, zinc and other non-ferrous smelting plants, ferro alloy production and different classes calcinations furnaces etc.) use alumina based refractory and cementing products, it is primarily the global iron and steel industry that has been driving the specialty alumina industries worldwide.

In the advanced steel making nations which are primarily engaged in producing high alloy and special steel, the specific consumption for high alumina refractory varies from 1.3 to 1.6 kg /t [8] of steel. In the technologically lower range of steel making nations like China and India, the specific consumption range of alumina based refractory is of the order of 0.5 to 0.9 kg/t. With Direct Reduction (DR) steel making processes gaining ground along with the secondary metal smelting sectors, (which have higher specific consumption levels of alumina based castables, lining blocks and mortars etc.), the overall average consumption rate could also move northwards at a faster rate in the coming years.

3. Supply chain and input cost security

The smelter grade calcined alumina industry has been facing increasing pressure with the rising cost of inputs and expenses of meeting stiffer regulatory norms. To maintain the economic viability of aluminium smelting and keeping alumina prices to meet the same, the alumina refinery capacities have rapidly moved from 100 000 - 200 000 tpa capacities in the 70’s to multimillion tpa and multi-line single site refineries. By the 1980’s and 1990’s, the ‘scale of economy’ for refineries had overtaken the equivalent captive demand of smelters. This resulted in the increasing availability of higher volumes of hydrates and alumina in the open market. However, this did not necessarily result in any pricing advantage in the supply of these two prime input materials for the specialty alumina industry and consequently for the refractory user industry.

In pricing hydrate and calcined alumina supplies for the non-metallurgical specialty alumina industry, the primary alumina producers had always loaded their own high capital cost contribution disproportionately. The final pricing was generally higher than that of transfer pricing for captive smelter consumption and most of the times, even higher than the open market smelter grade alumina prices.

The special alumina producing industries, world over, have been depending on the primary smelter grade alumina producers for sourcing their basic input raw material of hydrate and calcined alumina. In turn, technically and in terms of economics, the growth, pricing, and profitability of the industry has remained closely linked to the worldwide smelter grade calcined alumina producing industry.

Traditionally, for sizing of a production industry, the factors considered for evaluation have covered the elements of project financial accounting and its technical detailing. These factors have always been closely linked to the socio-economic and socio-political indices prevailing at the sites under consideration and the one finally selected for setting up of the production facility.

The iron and steel industry consumes over 90 % of the ceramic and refractory grade alumina based material produced in the world and continues to be the prime mover of the overall growth of special grade alumina industry. With the shift in the global metallurgical industry production base to Asia-pacific and Middle East region, there has also been a paradigm shift in evaluation of criteria for defining 'scale of economy' for special alumina projects. This calls for investors to take a serious look at the Asia Pacific Bauxite rich areas for setting up green field projects with captive bauxite sourcing.

It would be logical for investors to take a serious look in to the region keeping in mind the
Of late, opportunities have come up in Asia and other developing Bauxite rich regions where large number of smaller deposits are more easily available compared to the large concessions needed for setting up mega scale mechanised mining projects. Such smaller 10 - 30 Mt deposits are no longer attractive for the bauxite mining industry supplying large primary alumina refineries. The emerging business scenario in these regions seem to favour setting up of smaller capacity value added speciality alumina production facilities with bauxite from such smaller deposits as the raw material as against sourcing of hydrates and alumina from primary producers. Raw material security in terms of pricing, quality management and process compatibility favours lowering of the 'scale of economy' for future green field speciality alumina projects in the Asia-Pacific, Middle East and other Bauxite rich developing parts of the globe. It opens up opportunities for smaller and medium level industry investors to enter the industry as both standalone merchant and captive producers. This could not only result in better growth rate for the industry but also improve its costing and profitability, in the years to come.

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