AL11 - DIDION Rotary Processing: New Applications in Aluminum Smelters

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Abstract

Two new areas where DIDION rotary impact processing equipment can improve the efficiency of the operation and significantly reduce operational cost and advance housekeeping is in spent bath (electrolyte) processing and "basement" alumina / floor metal processing. The DIDION rotary impacting and sizing process can simply crush and size old bath or electrolyte removed from the pots, recovering the free aluminum and other metals that may be contained in the material and size the electrolyte or alumina for its reuse. This process saves accumulation of waste and unscreened materials and allows recovery of these materials preserving the value. [1,2,3]

Other DIDION uses at the smelter include crushing, sizing and recycling spent potlining (SPL), spent anodes and dross. This all can be handled with the same flexible system. Maintenance cost and downtime in ageing smelters on classic style crushing systems can be reduced by the simple DIDION system. A DIDION RT Crusher can replace and entire crushing line, encompassing several primary, secondary and tertiary crushers with one unit capable of receiving full size baked and scrap anode blocks and spent anodes at production rates up to 20 tonnes per hour.

Another DIDION application with a small modification is the anode thimble cleaning operation. This process is typically done with a series of storage hoppers and conveyors into a batch processing shot blast unit that uses steel shot as a consumable product and carbon contaminant and with age these systems become expensive to maintain. The DIDION thimble cleaner simplifies this process, requires less production space and produces a cleaner thimble.

Keywords: DIDION rotary processing, spent bath processing, SPL crushing and recycling, anode thimble cleaning, dross processing.

1. DIDION System – General Comments

The DIDION rotary impact and separation processing units are unique systems that can process several different smelter by product streams in the same processing line with very little modification for input product size or final screen sizes. This is achieved through the patented double liner configurations. The processing when coupled with a bag filtration unit of the appropriate size is a dust free operation. Very important when processing hazardous material such as SPL.

Labor requirements are low, typically one person to load and operate system with only basic training required. The aluminum smelter operation can benefit greatly from efficient recycling of their waste stream materials thru low cost, simple, rotary processing operations. Recovering many materials for recycling on site instead of shipping off site for secondary recycling or landfilling. Valuable alumina, bath and metal units are recovered.

DIDION is a proven work horse in difficult environments. It has widely developed uses and applications for rotary crushing and separation systems for the recycling and recovery of dissimilar materials that are often mechanically bonded together.

The development of this technology was started in the foundry industry in the early 1970s. The first step was the separating of metal castings from the foundry sand mold pieces in which they were created. These hot, heavy castings required the development of a very durable machine. The equipment was originally designed to run 24 hours a day, 7 days a week with minimal maintenance. This operating philosophy makes the DIDION systems perfect for the primary aluminum smelter where the attention should be focused on making aluminum and not problems with ancillary equipment. [4]

The continued improvement of the DIDION RT/RS TUMBLERS has made mechanical processing of mixed materials a very cost effective and low maintenance alternative to other processing systems. These flexible systems can perform surface scrubbing, crushing, screening and sizing in one single piece of equipment. The DIDION systems take up far less space than conventional crushing and screening process facilities. While at the same time the system requires less maintenance and manpower to operate. The RT/RS TUMBLER systems (Figure 1) contribute significantly to the aluminum industries potential ability to continue lowering its negative impact on the environment by this basic approach to bath, carbon, basement alumina, thimble, dross and salt cake processing.

Figure 1. 3-5 t/h, RT 72 Processing Unit.

1.1 Summary of Primary Plant Applications for the RT TUMBLER Processing System

- Bath crusher, sizer and separator in a single process with the ability to remove the tramp aluminum from this electrolyte in the same step.
- Tramp “basement” alumina, smelter metal floor waste separation.
- Carbon Reclaimer and Cleaner, scrubbing the bath off used carbon blocks before crushing and recycling and then crushing to the required size in the same piece of equipment.
- Spent Pot Liner Crushing and Material Separation.
- Removal of carbon and bath from cast thimbles in the anode rodding shop saving consumables and floor space over traditional shot belts methods.
- Separation of metallics from oxides and salts in dross and salt cake processing, with a significant environmental impact in the elimination or reduction in landfill materials.
- Alumina filter ball and burner ball cleaner/recycler.

Operational costs are very low. The largest unit operates with a 200 Kw drive motor, the smallest with a 22Kw drive motor. Processing cost per ton will vary with the size of the unit. The largest unit processing 20 tph has an operating cost of .75$/ton, considering all monthly maintenance capital cost and a cast liner replacement after 7 years of operation.

This processing cost/ton is exclusive of local labor cost. Certainly, with all labor included processing through these large units is less than $10.00/tonne.

Custom sizes thru puts and processing configurations are part of the DIDION philosophy of equipment design and can always be evaluated and normally accomplished.

The flexibility of the design configurations of the DIDION rotary processing equipment has many potential applications in the aluminum smelter environment. A single unit can independently process several different types of materials. These dynamic systems can lower overall processing cost by reducing manpower, maintenance, energy consumption and lowering the plant area required for the above-mentioned materials processing practices.

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