Recycling Spent Aluminum Oxide

In an effort to address this need, *Washington Mills* has worked with large volume users of BLASTITE® BT to collect and recycle the spent aluminum oxide and recycle it back into the aluminum oxide manufacturing process.

Over 150 000 t of fused aluminum oxide is consumed annually in the United States. A primary consumer of fused aluminum oxide is the metal preparation and finishing industry which uses it as an abrasive blasting media. In this application, the fused aluminum oxide grains, when propelled by air pressure, become powerful multi-edged abrasive tools that penetrate work pieces and leave clean, etched surfaces in their wake. The abrasive particles remove contaminants and unwanted substances from the metal's surface in order to give it the desired finish. Blasting with fused aluminum oxide is a highly effective method for either material removal or surface preparation on many different surfaces including: metals, alloys, glass, ceramics, marble, granite, and other stone.

Washington Mills' trademark BLASTITE® BT blasting grain is renowned as the abrasive grain of choice for the blasting industry. In pressure blasting, a pressurized stream of compressed air is directed through a nozzle and onto a work piece to create a uniform surface. The blasting is done either in a blast cabinet or in a large blast room that contains and collects the aluminum oxide after it has been blasted onto the part. Depending on the piece being blasted or the desired surface profile, the aluminum oxide may be collected and re-used for many passes through the blasting system in order to maximize the abrasive life of the grain. Once the abrasive particles have been reduced in size, the aluminum oxide must be disposed of.

Traditionally, the spent aluminum oxide is brought to a landfill for final disposal, but rising landfill costs, tighter landfill regulations, and higher freight costs are causing businesses to re-think their waste disposal practices. As one the largest manufacturers of aluminum oxide in the United States and the industry's top supplier of BLASTITE® BT to the blasting industry, *Washington Mills* is keenly aware of the growing need to find better ways to dispose of spent abrasive grain. In an effort to address this need, *Washington Mills* has worked with large volume users of BLASTITE® BT to collect and recycle the spent aluminum oxide and recycle it back into the aluminum oxide manufacturing process.

Washington Mills has invested significant research and development resources to make its aluminum oxide manufacturing process a completely closed loop manufacturing system. When other industry players closed down their aluminum oxide furnaces and opted to produce or source from China, *Washington Mills* made the strategic decision to continue manufacturing fused aluminum oxide in North America. Today, as the only manufacturer of fused aluminum oxide in North America operating its own furnace plants, *Washington Mills* is in the unique position of being able to re-introduce the spent aluminum oxide back into its furnace operation. In *Washington Mills*' recycling program, the spent aluminum oxide grit is re-used as an ingredient for making new fused aluminum oxide. Recycling used aluminum oxide by putting it back into the furnace that it originally came from and using it to make new fused aluminum oxide is a perfect 100 % closed loop manufacturing system.

While there are some other recycling options for spent aluminum oxide such as using it as an additive in asphalt or concrete mixes, there is no other recycling system that comes close to *Washington Mills* closed loop recycling program. The beauty of the *Washington Mills* recycling program is that our unique furnace expertise transforms the spent aluminum oxide back into raw materials used to make 100 % pure fused aluminum oxide through the furnace process. Whatever recycled material we reclaim can go right back into our furnaces. The perpetual recycling loop produces no waste and reduces the dependency on new raw materials. We are successfully making 100 % fused aluminum oxide from recycled material that has the same chemistry and crystal structure as fused aluminum oxide made from brand new raw materials.

Fig. 1 Brown aluminum oxide crude, grains and powders

Fig. 2 Electrodes melting raw materials to make fused aluminum oxide

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Fig. 3 A furnace operator takes a sample from the aluminum oxide furnace for quality testing

What may seem like a simple and elegant recycling process has taken many years of work and skill to develop. *Washington Mills* has worked hard over the years to modify its furnace operations in order to accommodate the use of spent aluminum oxide. Furnacing aluminum oxide is not a simple process. It requires charging the furnace with a raw material mix that has the correct chemistry and stability for the materials to fuse together effectively and safely. When introducing non-virgin raw materials such as spent aluminum oxide, the chemistry of the raw material mix is constantly changing. There are certain chemistries that the furnace process just can't reduce so *Washington Mills* has to be diligent about testing the recycled materials and mixing together the right ratio of materials in order to achieve the desired chemistry.

Washington Mills has a strict testing program on all spent aluminum oxide before the grit can be accepted for recycling. We spend a lot of time testing the chemistry of the material until we are certain that the spent material will work in our furnace process. *Washington Mills* only accepts non-hazardous material and cannot handle spent grain that contains hazardous waste. This reduces our ability to recycle every kind of spent aluminum oxide because depending on the surface that was being blasted, the spent grain may contain different metals or other elements that were collected and mixed in with the aluminum oxide in the blasting process. In many applications the small amount of debris in the spent grain does not pose a problem, but in others where perhaps lead, cadmium or other elements were taken off in the blasting process, the material wouldn't be considered for recycling. The recipe of raw materials changes with each new recycling shipment so we are continually improving how we manage the materials and adapting the raw material mix to suit our furnace process. Innovation through adapting our process to work with alternative sources of raw materials gives us a real manufacturing edge.

Unlike new raw materials, the spent material is often returned to us in much finer particle sizes. The material handling capabilities needed to manage materials of very fine particle sizes as well as a myriad of different packing types is a sizable challenge. Finer materials are more difficult to handle and must often be agglomerated before being fed into the furnace. Very fine material does not move well or release easily into the furnace so a considerable amount of work must be done to prepare the material before use. The material is returned to us in many different types of packages from sacs to drums to bulk, which makes operating an efficient material handling system a challenge. Despite the challenges, *Washington Mills* is convinced that the hard work it has devoted to its recycling program will pay real benefits – both in terms of offering a greater level of service to its customers, and in manufacturing a high quality product in North America at competitive prices. In today's world of soaring raw material and electricity costs and declining quality of raw material inputs, a recycling program that reduces dependency on expensive raw materials in order to control costs offers real value to fused aluminum oxide users. *Washington Mills* knows that by continuing to refine its closed loop recycling program, it is helping its customers break out of the one-way landfill trap of rising disposal costs. By bringing the spent material back into the furnace and transforming it into fused aluminum oxide, *Washington Mills* is truly a full service fused aluminum oxide supplier that aims to maximize the customer experience while innovating itself away from the tide of rising manufacturing costs.