PRODUCING LOW-COPPER SHRED FOR STEEL MILLS

Mike Shattuck
BDM Recycling - Heavy Industry, Eriez



Shred1 Ballistic Separator

A method for upgrading shredded scrap has been developed and optimised using the Eriez® Shred1® Ballistic Separator coupled with magnetic separation equipment. The resulting upgraded shredded scrap will lower the amount of copper-bearing material (typically less than 0.20%) and increase the grade of the scrap. This is accomplished by removing the misplaced nonferrous materials typically found in shredded scrap, thereby increasing yields in the steelmaking process.

This process allows shredder yards to provide a more desirable scrap to steel mills seeking a low-copper scrap. These steel mills gain a competitive cost advantage by using less pre-consumer scrap, pig iron/DRI (direct reduced iron/sponge iron), and more low-cost, low-copper shredded scrap in Electric Arc Furnace (EAF) sheet steelmaking.

Regular shredded scrap provided to steel mills ranges in copper content from 0.26%–0.56%, depending on the infeed material to the shredder and the downstream process after the shredder. After assays of shredded scrap from many different shredder sites, the determination was that the nominal copper content of shredded scrap provided to a (sheet) steel mill is usually about 0.31% copper.

Introduction

Sheet steel mills use a blend of pig iron, DRI, and pre-consumer scrap (bushing). Typically, only about 25% of lower-cost shredded scrap is used in the blend, with the remaining 75% being a mix of the higher-cost pig iron, DRI, and pre-consumer scrap.

With the high cost of pig iron, DRI, and premium scrap combined with the limited availability of these commodities, using a higher percentage of low-copper shredded scrap will allow steel mills to reduce the cost per ton of steel produced.

Process

In a scrap yard, the Shred1 Ballistic Separator is positioned after the primary scrap drums and a shredder, placed just before a picking station. Shredded material is fed to the Shred1 Ballistic Separator and accelerated up to 305 metres per minute (1,000 feet per minute). A unique magnetic element at the end of the separator attracts the more magnetic pieces of steel and drops them behind a splitter. The magnetically stronger steel is typically a bit smaller in size and has more points of contact on the magnet with less non-magnetic material entrapped. This is the low-copper stream (#1) and accounts for about 75% of the material stream. This material is conveyed to the stacking conveyor with no further action required.

The material that is less magnetic — usually heavier pieces that have non-magnetic material entrapped or not liberated — is more affected by the ballistics of the belt speed than the attraction of the magnet. This material is presented over a splitter, which is then discharged from the Shred1 Ballistic Separator and conveyed to a polishing drum. This less-magnetic material, which is known as the copper concentrate, represents the remaining 25% of the feed.



Shredded Scrap



Pre-consumer Scrap



Pig Iron



Direct Reduced Iron

The #2 shred stream is presented to a magnetic drum with a reduced magnetic field or a polishing drum. This drum is set to "cherry pick" the best ferrous material of the #2 stream, which is liberated from any copper-bearing materials. This material, typically making up 10%–15% of the #2 stream, will be blended back to the #1 stream and sold as low-copper shred. This increases recovery of the low-copper shred.

After the polishing drum, the #2 stream is presented to a picking station where copper-bearing materials and any nonferrous materials are ready for manual picking. This material can be sold to mills that do not require a low-copper product or to be sent for further processing to advance the liberation of copper from steel.

Testing

Material was collected from multiple scrap yards and processed under a Gamma Tech analyser to verify copper content of the feed material. With over 907 tonnes (1,000 tons) of material, the average copper content was 0.29%.

The Shred1 Ballistic Separator was set to produce a 75/25 split of material. Three quarters of the material would be the #1 (low-copper) stream and the remaining 25% would be the #2 (copper concentrate) shred stream. After processing the 907 tonnes (1,000 tons) on the Shred1 Ballistic Separator, the #1 stream was sent back under the analyser for assay where copper content was recorded at 0.16%. This represents a significant reduction in copper.

The #2 stream was sent under the polishing drum where an additional 10% of shred was recovered. This product was also sent under the analyser for assay. The results showed that the copper content was recovered at 0.18%. This shred can be blended back into the #1 material without adversely affecting the copper content of the #1 stream, all while increasing recovery.

The #2 stream material not recovered at the polishing drum was conveyed to a picking station where any copper-bearing material and/or nonferrous material can be manually removed. The reduced flow to the picking station (only 15% of the infeed) requires fewer pickers. The decreased feed allows pickers to work more quickly and efficiently since the material is lightly burdened and copper-bearing materials are easy to spot. Copper picking at a typical yard averages 5–7 lbs. per ton of shred. After installation of the Shred1 Ballistic Separator, the copper picking will typically rise to 12–14 lbs. per ton of shred.

Conclusion

By installing a Shred1 Ballistic Separator and a polishing drum, scrap yards can now provide premium low copper shredded scrap to steel mills while reducing labor and increasing copper pickings. In many instances the lower copper scrap commands a premium price per ton.

About Eriez

Established in 1942, Eriez is a global leader in separation technologies. Our commitment to innovation has positioned us as a driving market force in several key technology areas, including magnetic separation, flotation, metal detection, X-ray inspection, and material handling equipment. The company's 1,000+ employees are dedicated to providing trusted technical solutions to the mining, food, recycling, packaging, aggregate, and other processing



Shred1 Ballistic Separator installation with Polishing Drum

industries. Headquartered in Erie, Pennsylvania, USA, Eriez designs, manufactures, and markets on six continents through 12 wholly owned international subsidiaries and an extensive sales representative network.

For more information, call 814.835.6000, visit www.eriez.com or email eriez@eriez.com. Eriez World Headquarters is located at 2200 Asbury Road, Erie, PA 16506.

Headquarters
2200 Asbury Road
Erie, Pennsylvania 16506, USA

+1-814-835-6000
eriez@eriez.com
www.eriez.com