

HARDOX in plastic recycling

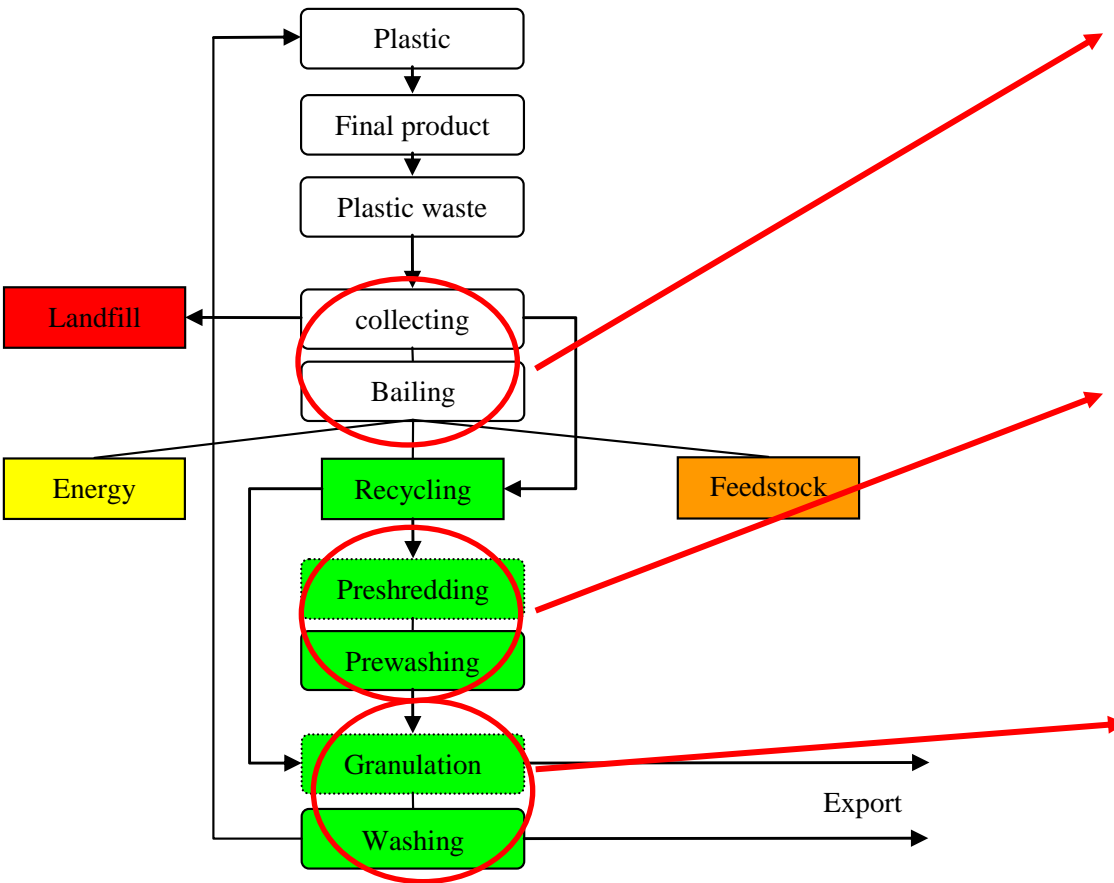


Types of plastic

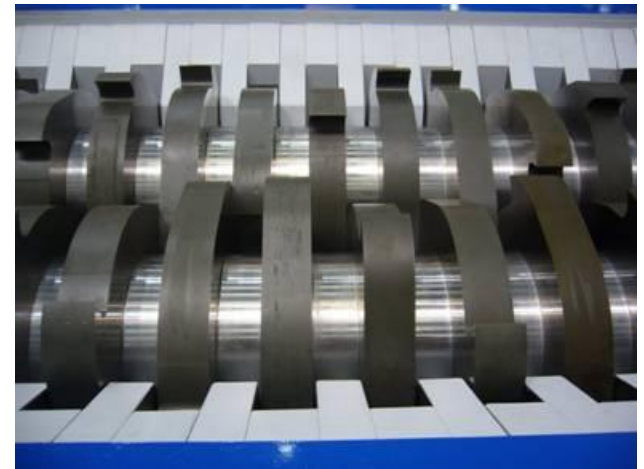
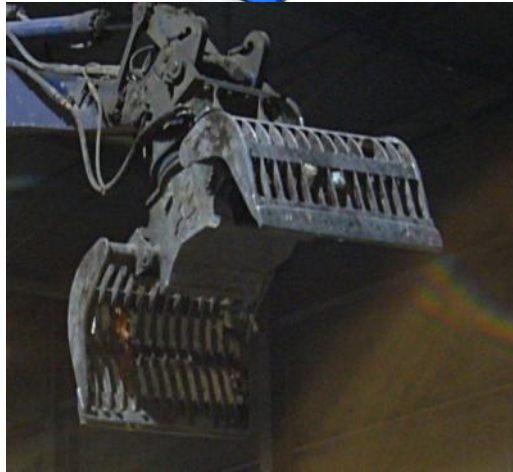
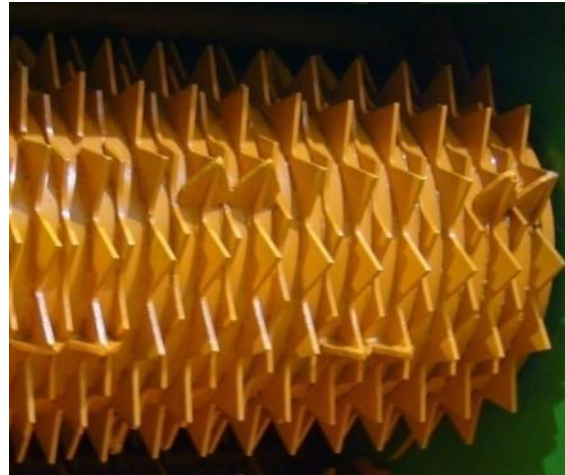


Plastic is not abrasive it is the contamination in the plastic waste that is abrasive

The plastic recycling process



Applications



Applications - Perforator

The perforator punctures the containers and allows air to escape when compressed in the baler or compressor. Perforators usually puncture and flatten plastic bottles by using a drum rotor equipped with small teeth.



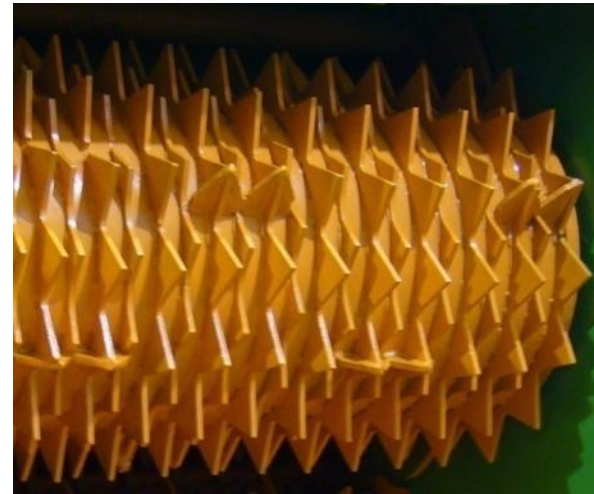
Recommended material:

HARDOX 450 in the roll

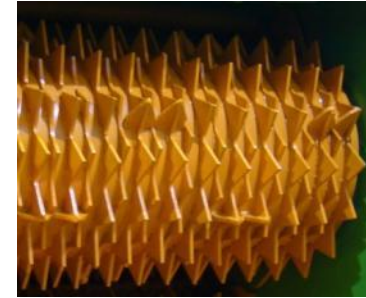
HARDOX 450 inlet

HARDOX 600 or HARDOX 550
in the teeth

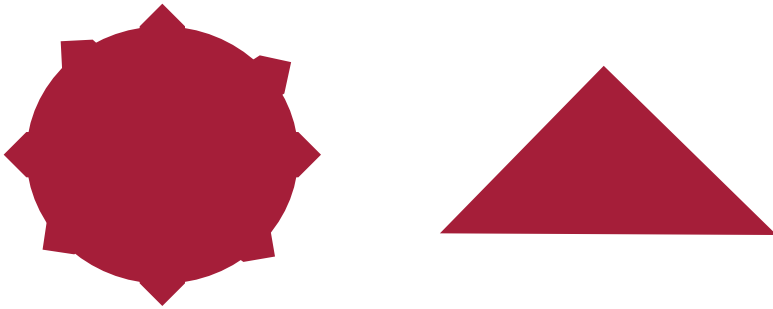
HARDOX 500 in the teeth (up to
12 mm) no preheating



Applications - Perforator



The teeth are either made of smaller pieces that are welded to place or they are made of circular bigger piece.



Recommended cutting:

1. Abrasive water jet
2. Laser
3. Plasma under water

Due to small parts and important with high hardness at the edge

Applications - Baler

Balers are produced with a variety of design but the main function remains the same and that is to compress the material with the purpose to facilitate the material handling. Balers exist in both stationary and mobile models. The most of the balers used in the plastic recycling industries are multipurpose balers capable of handling different kinds of material.

Recommended material:

HARDOX 450 in the housing

HARDOX 500 in the dispatch edge

HARDOX 500 in shearing beam

HARDOX 600 in shearing knife



Applications - Grabber

One of the most common ways to move plastic waste and load the shredders is with a grabber. The wear on grabber that is used to move plastic waste is mild. Most wear occur on the tip on each leg when the grabber slides against the ground.

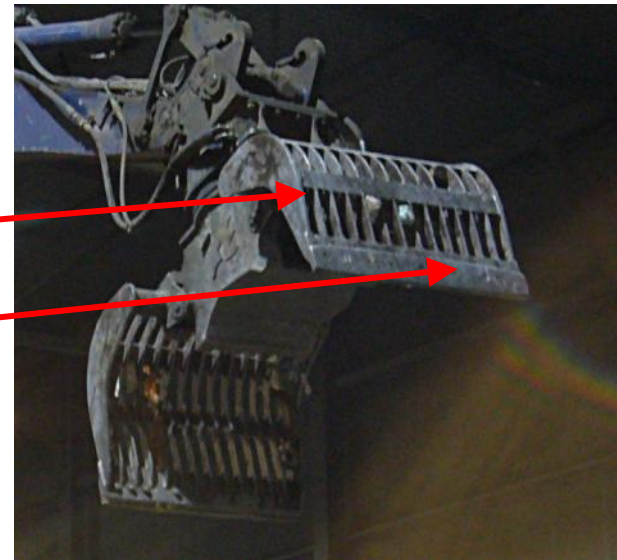


Recommended material:

HARDOX HiTUF

WELDOX 700

HARDOX 500 in the Cutting Edge



Applications - Shredder

Different types:

High torque multipurpose shredder

High speed shredder with teeth

High speed shredder with knives



Applications - Shredder



Knife Design



Simple design better
for HARDOX



Applications - Shredder

Shredder Design



Applications - Shredder

The anvil acts as the counterpart to the knife. The fact that the anvil is static means the problem with chipping of the anvil edge is nearly none existing. But the wear is still severe due to the tight tolerances between the knife and the anvil. Plastic waste and hard particles in the waste wear on the anvil with high pressure, causing rapid wear.

Anvil Design

Recommended HARDOX grade:
HARDOX 550 or HARDOX 600

Applications - Shredder

The screen in a plastic shredder and the size of the holes in the screen influences the size of the plastic flakes. Thus is screens an important part of a shredder. The size of the holes influence the wear on the knife. Smaller holes force the waste to be cut more times before the processed waste is small enough to leave trough the screen.



Screens

Recommended HARDOX grade:
HARDOX 400, 450 & 500
Depending on available bending capacity and the wear situation.

Important with good qualities of the cut edges. Otherwise cracks can appear during bending.



Applications - Shredder

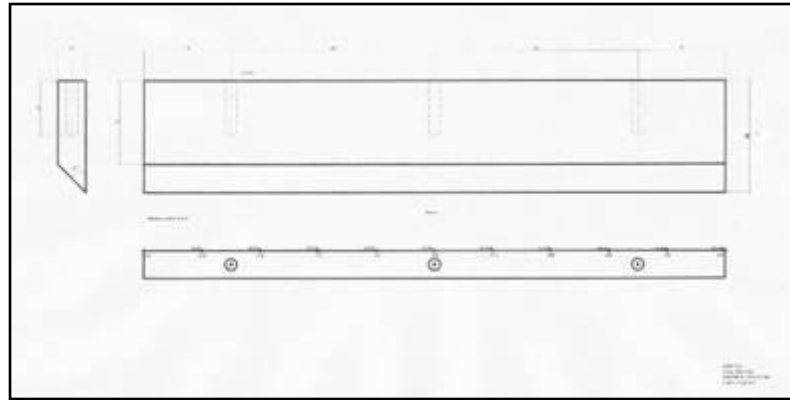
The shredder and especially the rotor house should have a design that makes it possible for air to flow through the shredder and rotor house. Compact and closed rotor house, accordingly is bad from a HARDOX point of view. Problems associated with generated heat:

- Tempering effect on HARDOX plates
- Melting of the waste product (this problem is rather unusual)

Cutting chamber

Recommended HARDOX grade:
HARDOX 450

Case study



Case study - test

Tool steel with 10.6 % chromium content

Average hardness: 675 HV

Impact toughness: 4 J at -40

Problem when hard objects enter the shredder - chipping

HARDOX 550

Typical hardness: 550 HB

Impact toughness: 30 J at -40

HARDOX 600

Typical hardness: 600 HB

Impact toughness: 20 J at -40

HARDOX Extreme

Typical hardness: 650 to 700 HB

Impact toughness: <15 J at -40



Regrinding after 48 h

Case study - test

HARDOX Extreme was superior to original material.
Same wear rate and no chipping



Toolsteel



HARDOX Extreme

Conclusions – shredding knives

Pros when using HARDOX Extreme and HARDOX 600 in shredding knives

- | | |
|----------------------------------|---------------------------|
| –No heat treatment is needed | Fewer manufacturing steps |
| –High hardness through the plate | Can be regrind more times |
| –Excellent toughness | Less chipping |

HARDOX is the better choice

HARDOX or not in shredding knives

Chance of success

	Low	Medium	Good
Knife design	Needs tapping	Needs drilling/machining	Only cutting
Knife design	Complicated design		Simple design
Knife design		Small tolerances	Big tolerances
Cutting	Gas cutting	Gas cutting under water	Abrasive water jet
The waste	Clean plastic waste		Dirty plastic waste
Type of plastic		Hard plastic	Soft plastic
shredder	Closed cutting chamber	Open cutting chamber	Water cooled

Why HARDOX in plastic recycling

- High Hardness
- Excellent toughness
- Excellent Work Shop properties
- Even properties

Long life time
Less sensitive to impurities, less failures
Simplified manufacturing
Easier to plan maintenance stops

Lower overall cost