



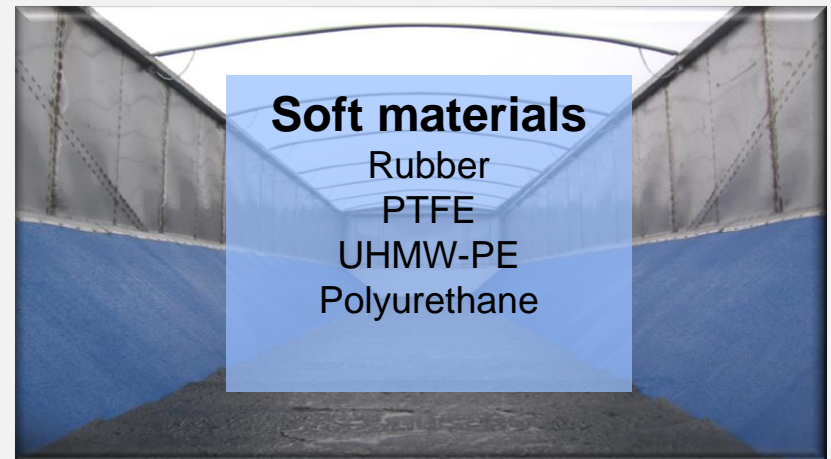
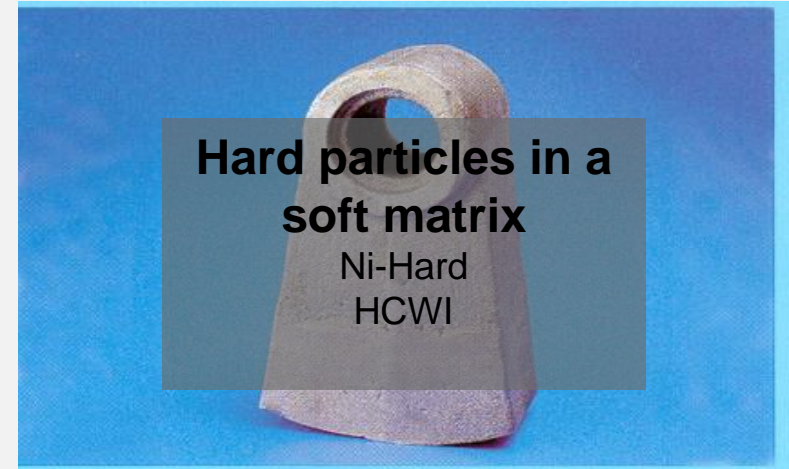
Recycling X-days APAC Productive and efficient recycling applications with Hardox

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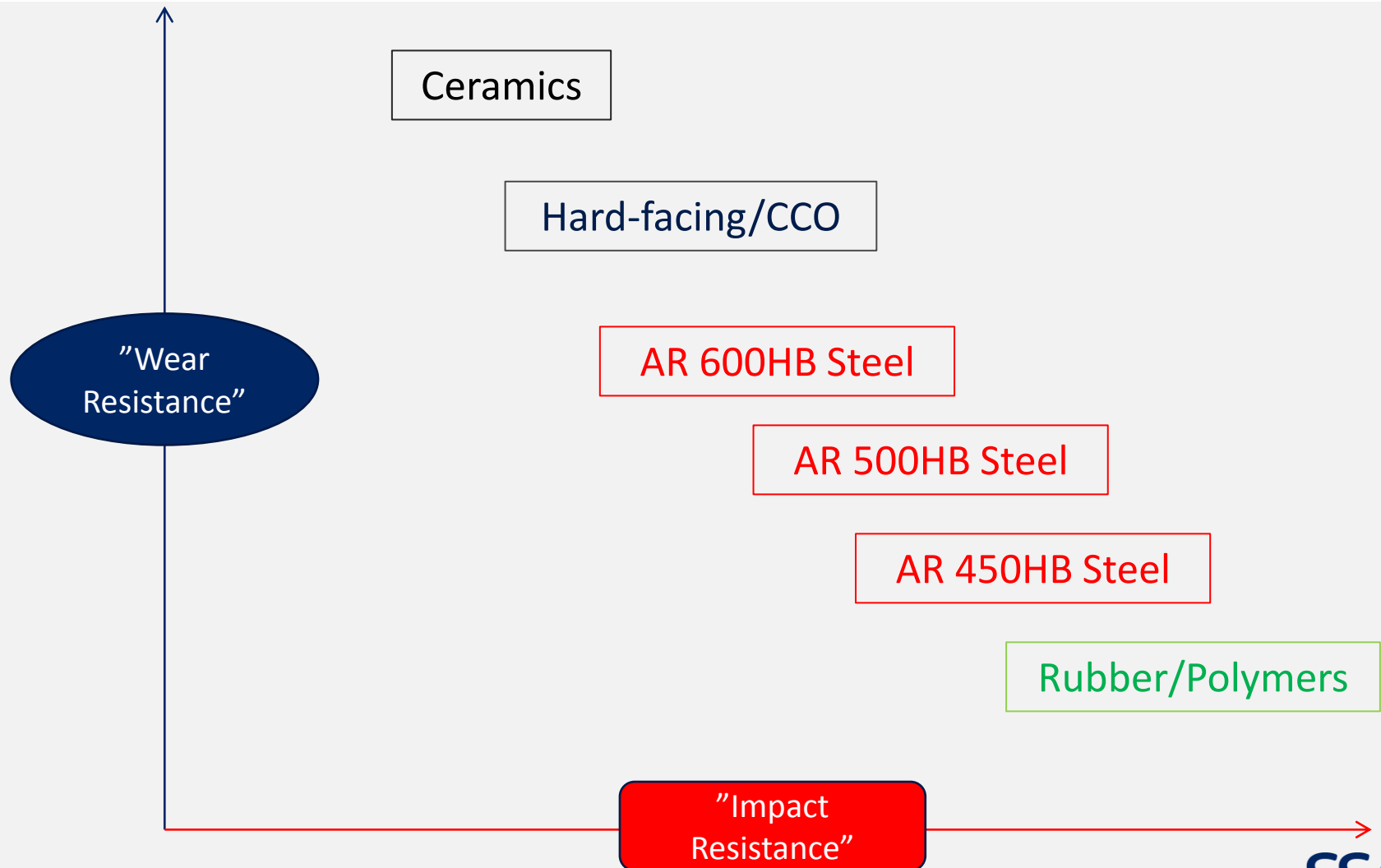
SSAB

Materials

Wear resistant materials



Wear resistant materials



Wear resistant materials

Material	Sliding wear	Impact wear	Toughness	Welding	Bending	Machining	Cutting
QT-Steel	Very Good	Very Good	Very Good	Good	Poor / Good	Medium / Good	Good
Ceramics	Excellent	Poor	Poor	----	----	----	----
Mn-Steel	Medium	Very Good	Excellent	Medium	Possible	Medium	Poor / Medium
HCWI	Excellent	Good/Medium	Poor	Casting - Poor Hardfacing – Good	Overlay-Medium	Not Possible	Poor/Medium
Ni-Hard	Very Good	Medium	Poor	Not Possible	Not Possible	Not Possible	Not Possible
Rubber	Poor	Good	----	Gluing	----	----	----

The advantage of Hardox

Starting point

- ▶ Manganese hammers 110 mm for recycling building waste



Hardox 550

Two hammers in Hardox 550 50 mm oxycut under water and machined HAZ. This concept has two hammers that work independent of each other as lammellar hammers. No welding together of the hammers



Result

- The service life of the twin hammers in Hardox 550 in 50 mm was 140 hours and meant a 40 % increase in service life compared to one manganese hammer in 110 mm
- We are testing same approach for metal scrap

Economical impact for the end user (indication)

	CASTING HAMMERS	TWIN HAMMERS
Quality	Manganese Casting	Hardox 550
Size	412 x 302 x 100	417 x 330 x 50
Weight kg.	64	32
Nº Hammers	14	28
Service life (hours)	100	140
Sets/ year	11	7
Price (€/hammer)	250	143
Total Price/set (€)	3.500	4.004
Total cost/year (€)	38.500	28.028

The customer has 40 % more service life and saves around € 10.500 /year

The advantage of Hardox 600

	MS	Hardox 400	Hardox 500	Hardox 600
Hardness	140 HB	400HB	500HB	600HB
Plate price	2200	4500	5000	6500
Drilling costs	1600	2000	2400	2900
Cutting cost	250	270	300	350
Transport cost	300	300	300	300
Attaching plates	1100	1100	1100	1100
Service life	1.0	2.1	4.5	6.3
Lifetime in days	100	210	450	630
Total costs / life days fictive money	54.5€/day	39.0€/day	20.2€/day	17.7€/day

E-waste recycling



- ▶ Processing 33.000 tons/year
- ▶ Everything from TV, computers and cables

Shredder knives



- ▶ Today chrome-molly steel-280HB
 - Service life 4 months
- ▶ Alternative Hardox 600
 - Expected service life 8 months with waterjet cutting

Application arguments

Waste refusal/garbage trucks

Important properties

- ❑ (Service life (Hardness))
- ❑ Payload – reduced weight (Strength)
- ❑ Crack resistance (Toughness)
- ❑ Dent resistance (Strength)
- ❑ Surface (Clean production)

Important properties for the manufacturer

- ▶ Flatness
- ▶ Thickness tolerances
- ▶ Hardness range (+/- 25 Hb)
- ▶ Less material on the floor

S355

Hardox 400, **450** Strenx 700



Containers

Important properties

- ❑ Service life (Hardness)
- ❑ Payload – reduced weight (Strength)
- ❑ Crack resistance (Toughness)
- ❑ Dent resistance (Strength)
- ❑ Surface (Clean production)

Important properties for the manufacturer

- ▶ Flatness
- ▶ Thickness tolerances
- ▶ Hardness range (+/- 25 Hb)
- ▶ New design – less stiffeners

S355 is used frequently

Hardox 400, **450** Strenx 700



Container

Total solution

- ▶ Hardox 450 for the body
- ▶ Stenx for the frame



Grapples

Important properties

- ❑ Service life (Hardness)
- ❑ Crack resistance (Toughness)
- ❑ Dent resistance (Strength)

Important properties for the manufacturer

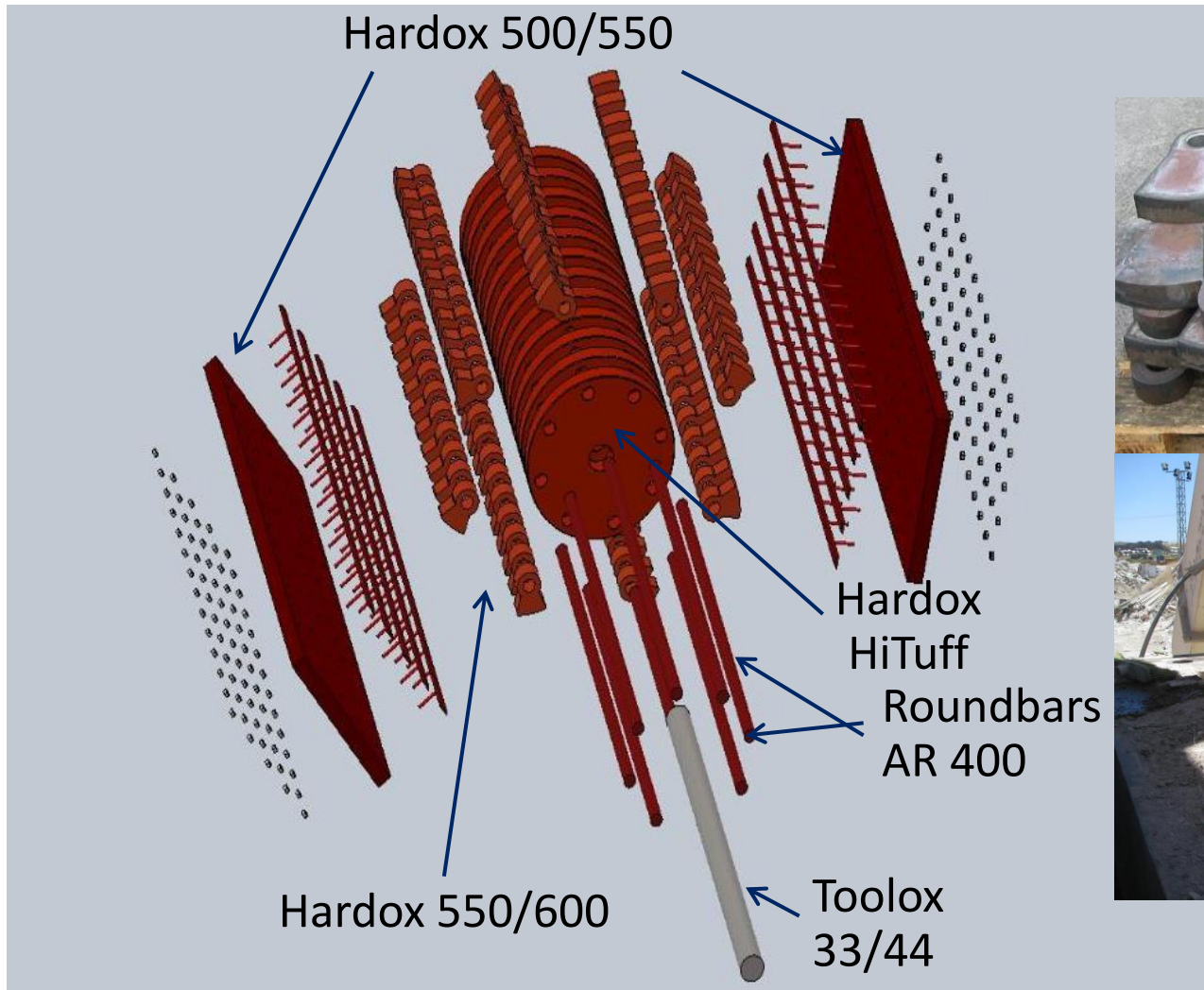
- ▶ Cutting
- ▶ Weldability
- ▶ Hardness range (+/- 25 HB)
- ▶ Bendability

S355 is used frequently

Hardox 400, **450, 500**, 600 Strenx 700



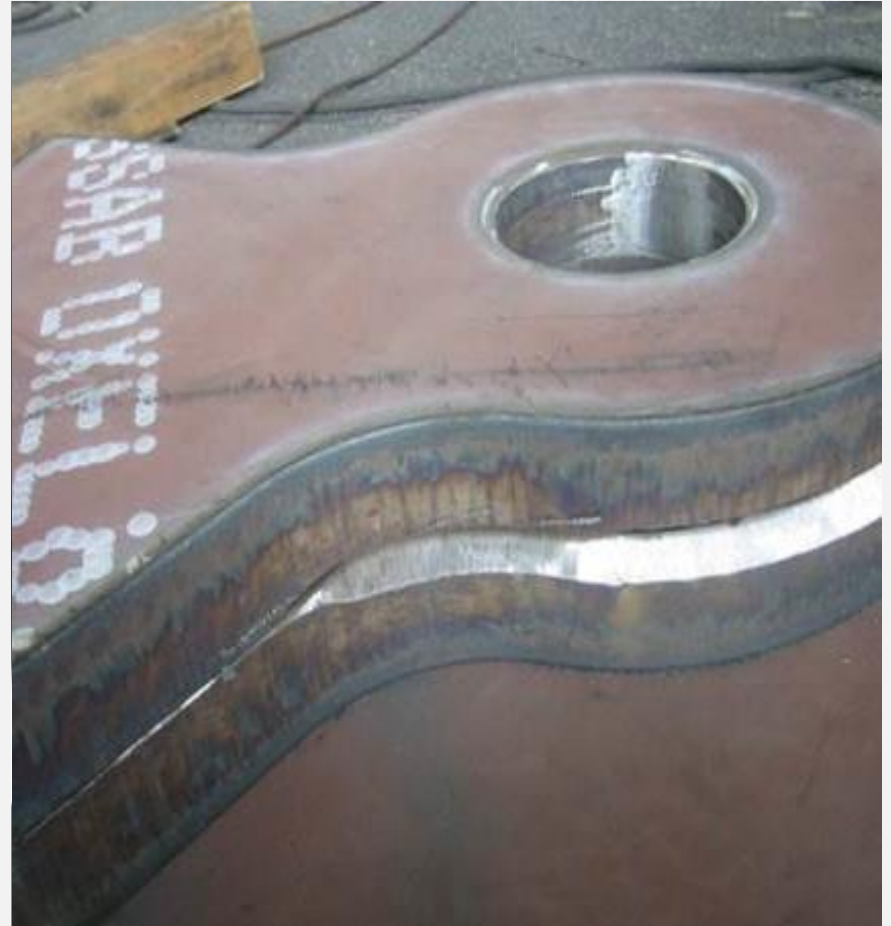
Hammer mill



The success of Hardox hammers

Hammer lifetime measured in scrap volumes:

- S690QL – 1600 tons
- Hardox 400 – 2500 tons
- Original 12%Mn steel – 7000 tons
- Advanced 12%Mn steel – 9700 tons
- Hardox 500 (sandwich 120 mm) – 14500 tons



Hammers

Important properties for selling to the end user

- ☐ Service life (Hardness)
- ☐ Crack resistance (Toughness)
- ☐ Through-thickness properties (Toughness, hardness)
- ☐ Less down time and maintenance
- ☐ Increased production

Important properties for the manufacturer

- ▶ Cutting!
- ▶ Machinability
- ▶ Hardness range (+/- 25 Hb)

Often Mn steel

Hardox **500, 550, 600 (thick)**



Scrap shears

Important properties for selling to the end user

- ❑ Service life (Hardness)
- ❑ Crack resistance (Toughness)
- ❑ Through-thickness properties (Toughness, hardness)
- ❑ Less down time and maintenance
- ❑ Increased production

Important properties for the manufacturer

- ▶ Cutting!
- ▶ Machinability
- ▶ Hardness range (+/- 25 Hb)

Often tool steel

Hardox **500**, 550, **600**, Strenx 700



Liner plates in feeders

Important properties for selling to the end user

- ❑ Service life (Hardness)
- ❑ Crack resistance (Toughness)
- ❑ Less down time and maintenance
- ❑ Increased production

Important properties for the manufacturer

- ▶ Cutting!
- ▶ Hardness range (+/- 25 Hb)

S 355, other QT, CCO

Hardox 550, **600**



Balers

- Cars are more and more produced in high strength steels
- Extreme sliding wear on bottom and side liners
- Extreme pressure on the tool that forces the car getting smaller

Important properties for selling to the end user

- ☐ Service life (Hardness)
- ☐ Crack resistance (Toughness)
- ☐ Liner replacement

Important properties for the manufacturer

- ▶ Cutting!
- ▶ Hardness range (+/- 25 Hb)
- ▶ Tolerances

S 355, other QT, tool steel

Compressor head Toolox 44 Nitrided.
Side liners and bottom liners Toolox 44.



Striker bars

Important properties for selling to the end user

- ❑ Service life (Hardness)
- ❑ Crack resistance (Toughness)
- ❑ Less down time and maintenance
- ❑ Increased production

Important properties for the manufacturer

- ▶ Cutting!
- ▶ Hardness range (+/- 25 Hb)
- ▶ Support for parts

CCO

Hardox 600



Applications that work - Reference cases

Scrap shears



- Hardox 550 – 600
- Successfully tested Hardox 600 80 mm

Rotor discs (often in a hammer mill)

- Hardox 400, **Hituf**, **Strenx 700** when **over 100 mm**, Hardox 450
- Thick material
- Tolerances
- Inner stress



Shredders for metal scrap recycling

- ▶ Hardox 450 and 500
- ▶ Knives



Tyre recycling

Hardox 600 12 - 35 mm



Ripper tooth for a rotary shear

- ▶ Previous material S355, t= 60mm and hardfacing
- ▶ Material now Hardox 450, t=60mm and hardfacing
- ▶ Why change?
Tooth be bent during crushing operation



Shredder in tire and rubber recycling

- ▶ Knives Hardox 500 - 600, Extreme (15-50mm)
- ▶ Average lifetime: 2-3 months



Scrap shredder

- ▶ Steel grade: Hardox 500 / 550
- ▶ Thickness range 30-60 mm
- ▶ Previous material S355
- ▶ Service life: 3 to 4 times longer than S355



Crusher in glass recycling

► Hammers

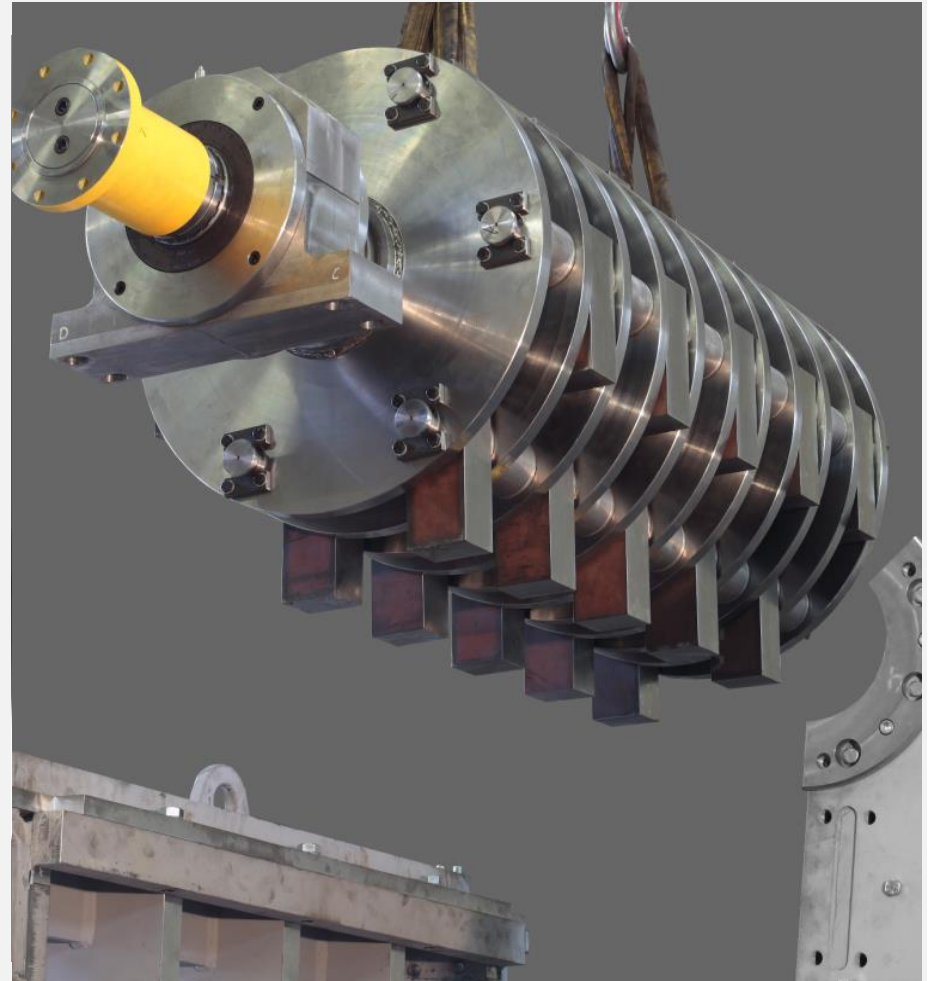
Hardox 600 25 or 30mm

Lining Hardox 450 10 and 15 mm



Hammer mill in E-waste

- ▶ Fine grinding
- ▶ Discs 35 mm Hardox 450
- ▶ Hammers 80 mm Hardox 450
- ▶ Lifetime: 2 month



Flat die pelleting press

- ▶ Material Hardox 450/Hardox 500
- ▶ Working in a waste recycling mill in Berlin
- ▶ Parts were upgraded from nitrided steel to Hardox
- ▶ Pellet diameter 30 mm



Crusher knives



Pictures of a knife mounted on a shredder that operates in a rubbish dump, reducing the volume of garbage. With the customer we have done 4 experiences: HX500 - HX550 - Tx44 - Tx44 nitrided. HX550 is the best compromise quality / price.

AR550 – 75mm wear parts for a stone crusher replacing casted with high chromium content (almost 600 HB), but very fragile

Shredder knives for plastic recycling

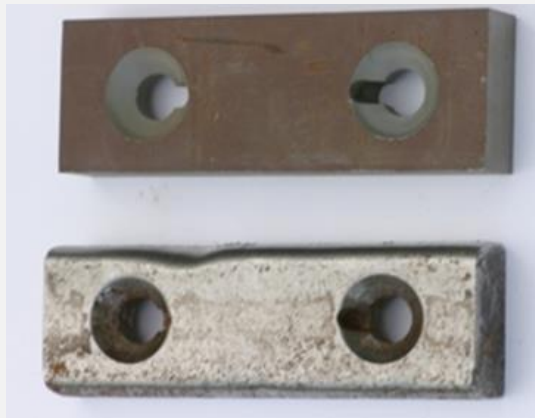
Lindner Komet 280



Hardox Extreme 30 mm

Shredder knives for E-waste

- ▶ Hardox 600, Hardox Extreme
- ▶ For milling electric waste such as cables, synthetic material etc



To keep in mind

- ▶ Understand the material processed and what kind of wear it imposes to the application
- ▶ What are the dimensions of the machine
- ▶ Be aware of areas where temperature over 250 degrees
- ▶ Service life needed → less downtime and repair
- ▶ Weight saving → more payload and less fuel consumption
- ▶ Total wear cost
- ▶ Availability and flexibility
- ▶ What support and service is needed
- ▶ Processing Hardox → follow our recommendations
- ▶ Tolerances

HARDOX®
WEAR PLATE

**HARD
AND
TOUGH**

SSAB