Shredded Scrap-Strong impact reducing the steel cost and increasing productivity

废钢破碎料-对降低炼钢成本及提高产能有着巨大的影响

Barcelona, 28th May2018

巴塞罗纳,2018年5月28日

adelca

Acería del Ecuador

Main objective 目的

- I want to present some conclusions about using shredded scrap as the main ferrous source for steel production – with a focus specifically on electrode consumption.

我想总结一下：关于炼钢主要采用废钢破碎料 – 此处重点关注电极消耗

THE COMPANY 企业背景介绍

- ADELCA is the most important Ecuadorian steel maker and is head-quartered near Quito, Ecuador, South America.

ADELCA是厄瓜多尔最重要的制钢厂，总部位于南美洲厄瓜多尔基多附近

- Current producion capacity is 800.000 tpy of rebar, wire rod and small shapes.
  目前产能是800.000 吨/年 ， 主要原料是钢筋、线材及小型钢材

THE MELTSHOPS 冶炼车间

- The Aloag Plant: 300.000 tpy – June 2008- Rebar & small shapes
  Aloag车间: 300.000 吨/年 - 2008年6月-原料：钢筋和小型钢材

  New Milagro Plant: 500.000 tpy - February 2018 – Wire rod & rebar
  新的Milagro车间: 500.000吨/年- 2018年2月-原料：线材和钢筋

- In 2008 Adelca began its steel melting operation using the most basic scrap sources.
  2008年，Adelca开始了炼钢业务，起初就是采用最普通的废料。

THE ECUADORIAN SCRAP 厄瓜多尔的废料

ADELCA`S MIX
PRESSED & SHEARED AND BUNDLE SCRAP

ADELCA钢厂的的剪切料和压块

PROBLEM WAS - NON-FERROUS MATERIAL IN THE SCRAP
-SOIL, ROCKS AND OTHER IMPURITIES
问题是——废料中所含的非铁料——如土、石头及其他杂质

ORIGINAL SCRAP MIX
原混合废料

Pressed and sheared 剪切料	50%
Bundles 压块	30%
Oxi-cut 氧气切割	10%
Cast iron 铸铁	5%
Others 其他废料	5%

Charge density 电荷密度	0,45	ton/m³
Ferrous Scrap 含铁废料	82%-85%	
Soil (65%-75% SiO_2&Al_2O_3) 土(65%-75% SiO_2&Al_2O_3)	10%-12%	
Plastics-PVC-Others 塑料PVC-其他	4%-5%	
Non-Ferrous scrap 有色金属废料	1%-2%	

- Low density.低密度
- Dirty scrap.较脏废料

ORIGINAL
OPERATION OUTPUTS
原运营产能

Total Metallic Charge 总的金属炉料	32,0	ton
Number charge Buckets 料斗装料次数	5,0	
Lime 石灰	62,0	kg/ton
Carbon 碳	21,9	kg/ton
Ferro alloys 铁合金	15,1	kg/ton
Oxigen 吹氧	36,0	Nm^3/ton
GLP (Liquid petroleum gas) 液化石油气	4,0	Nm^3/ton
Electrode consumption 电极消耗	2,8	kg/ton
Refractory consumption 耐火材料消耗	18,0	kg/ton
Yield Rate 收益率	85%	
Tapping weight 出钢重量	27,2	ton
Tapping temp 出钢温度	1615,0	ºC
Energy Consumption 能源消耗	580,0	kwh/ton
Power on 送电时长	50,2	minutes
Power off 断电时长	17,5	minutes
Tap to tap time 冶炼时间	67,7	minutes
Apparent power 总功率	25,5	MVA
Active power 有效功率	18,9	MW
Maintance and operation delays 维修和操作延迟	19%	
Total melting time 冶炼时间占比	81%	
Productivity 产能	19,54	ton/h
Montly production 月产能	14.067	ton/month
Slag 熔渣	20%	

THE PROJECT
TO INCREASE PRODUCTIVITY INCLUDED:
后期提高产能采取如下措施

- Increasing the furnace transformer size from 25 MVA to 42 MVA.
  将炉用变压器的容量从25mva增加到42mva

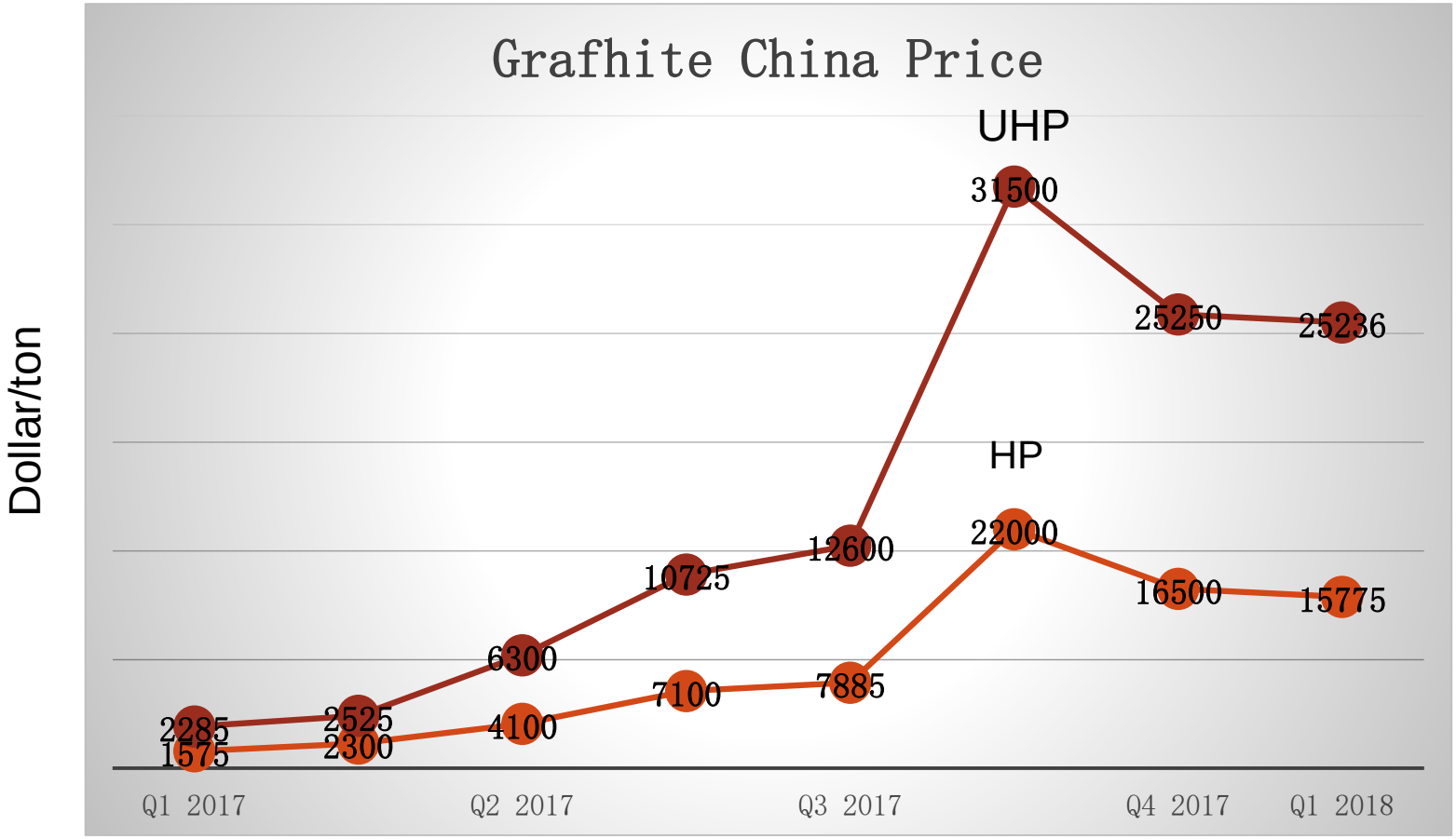
- Adding a 4000HP scrap shredder & a separation/cleaning system Sourced from -The Shredder Company (TSC) .
  从美国纽维尔公司（TSC）购买了一台4000HP的废钢破碎机生产线包含一套分选系统

- Challenging convencional charging mixes & greatly reducing charging times by using up to 80-90% shredded scrap.
  挑战以往的混合废料，通过使用高达80-90％的废钢破碎料，大大减少了装料次数

THE NEW OPERATION
采用新的运营方式

Metallic Charge 总的金属炉料	32,0	32,0	ton
Number charging Buckets 料斗装料次数	5,0	2,0	
Lime 石灰	62,0	29,4	kg/ton
Carbon 碳	21,9	21,9	kg/ton
Ferroalloys 铁合金	15,1	15,1	kg/ton
Oxigen 吹氧	36,0	36,0	Nm³/ton
GLP (Liquid petroleum gas)液化石油气	4,0	4,0	Nm³/ton
Electrode consumption 电极消耗	2,8	1,6	kg/ton
Refractory consumption 耐火材料消耗	18,0	9,5	kg/ton
Rate Yield 收益率	85%	94%	
Tapping 出钢重量	27,2	29,9	ton
Tapping Temp 出钢温度	1615,0	1615,0	ºC
Energy Consumption 能源消耗	580,0	445,0	kwh/ton
Power on 送电时长	50,2	30,0	minutes
Power off 断电时长	17,5	10,0	minutes
Tap to tap 冶炼时间	67,7	40,0	minutes
Apparent power 总功率	25,5	35,0	MVA
Active power 有效功率	18,9	25,9	MW
Maintance & operation delays 维修和操作延迟	19%	18%	
Total melting time 冶炼时间占比	81%	82%	
Productivity 产能	19,54	36,80	ton/h
Montly production 月产能	14.067	26.497	ton/month
Slag 熔渣	20%	8%	

Grafhite 中国售价



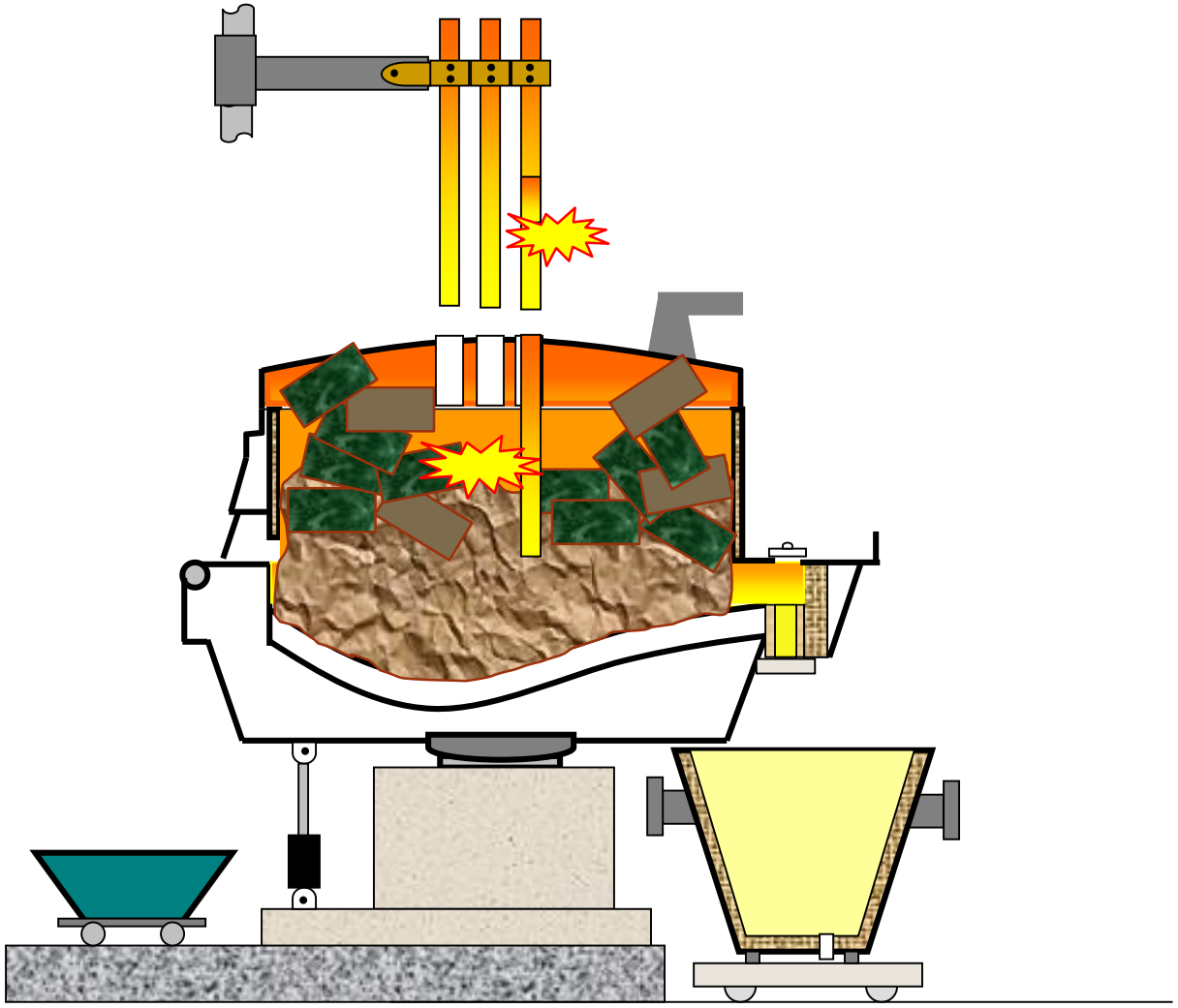
Types of electrode consumption
电极消耗类型

- Electrode breakage.
  电极折损

- Electrode side consumption.
  侧电极消耗

- Electrode tip consumption.
  前端电极消耗

Electrode Breakage
电极折损



Electrode Consumption without Breakage
无折损的电极消耗

- Side consumption.
  侧电极消耗

- Es (kg/t)= $N * L * \pi * De * \frac{1+\frac{Dt}{De}}{2} * \frac{(ts+tn)}{Ga} * Fs$

- Tip consumption.
  前端电极消耗

- Et (kg/t)= $N * I^2 * \frac{ts}{Ga} * Ft$

Total Consumption = Et + Es
总消耗= Et + Es

N = number of electrodes
电极数量
L = oxidizing electrode length (meters)
氧化电极长度(米）
De = diameter of electrodes (meters)
电极直径(米)
Dt= diameter of electrode tip (meters)
前端电极直径(米)
Dt/De = 0,68 for AC: 0,82 for DC

ts = power off (hours) 断电时长（小时）
tn = power on (hours) 送电时长（小时）
Ga = tapping weight (tones) 出钢重量（t）
***I* = electric current (Kilo Amperes)**
电流(千安)
Fs = side factor 6 (kg/hour.m2)
侧电极损耗系数6 (kg/hour.m2）
Ft = tip factor 0,013 (kg/hour.kA2)
前端电极损耗系数 0,013 (kg/hour.kA2)

State of the art & future trends, EAF Technology, International Iron and Steel Institute, Committe on Technology Working Group on EAF technology, 2000

Oxidizing electrode length
氧化电极长度

Electrode Consumption without Breakage
无折损电极消耗

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- Tip consumption.
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Meltshop

2017

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Electrode consumption 电极消耗		1,55	kg/ton
Refractory consumption 耐火材料消		7,5	kg/ton
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Labor cost 人工成本

38 heats/day

Slag disposal 熔渣处理

Non ferrous 非铁料

Dust disposal 粉尘处理

Sales 销售额

Savings 节省

6,5$/Ton

25,0 $/Ton

15,8 $/Ton

12,15 $/Ton

Total

60$/Ton

CONCLUSIONS 结论

- The Shredding process has a strong impact in the steel making industry, reducing the direct cost up to 60 $/ton, and increasing the productivity of the EAF.
使用废钢破碎料对炼钢行业有着巨大的影响，可降低直接成本高达60美元/吨，并大大提高了电炉的产能。

- The productivity improvement related to using more shredded scrap could be up to 50%, reducing other collateral costs
通过使用更多的废钢破碎料，产能可提高至50%，并减少其他附加成本

- The electrode consumption savings of using a higher percentage of shredded scrap input could reach up to $20 - $25 dollars per ton of liquid steel .
通过加入大量的废钢破碎料，每冶炼一吨钢水可以节省电极消耗达20 - 25美元

Excel simulator

Andres Albuja Ribadeneira