



RawMaterials

Connecting matters

A brief Introduction to Stainless Steel Industry Side Streams



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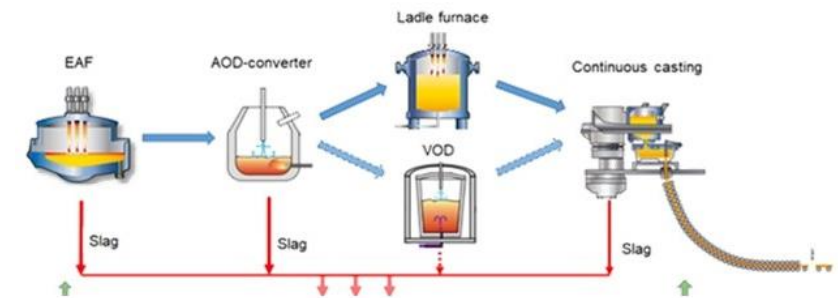


STAINLESS STEEL – NOT ALL STEEL IS THE SAME

- Like all types of steel, stainless steel is not a single metal but an alloy that is a material made from two or more separate elements alloyed together; the major ingredient is the metal iron with a minimum of 11 % chromium content and a maximum of 1.2 % carbon
- For applications where both the strength of steel and corrosion resistance are required such as cookware, kitchens, food processing plants
- More information: <https://www.worldstainless.org/>
- Production process
 - EAF (Electric Arc Furnace) in which ferrous scrap and ferro alloys (Fe Cr, Fe-Ni, Fe-Mo...) are melted
 - AOD (Argon Oxxygen Decarburization) allows the removal of carbon and other composition adjustments to achieve the desired composition
 - LF (Ladle Furnace) adjust the final chemical composition and temperature
 - VOD (Vacuum Oxxygen Decarburization) enhances decarburization
 - Continuous Casting in which the molten metal is solidified into slabs (0.2m x 2m) or blooms (0.2m x 0.2m)

Stainless steel	Carbon steel
Resistant to rust	Vulnerable to rust
Less wear-resistant	Wear-resistant
Less brittle	Brittle
58.3 Mt/a (in 2021)	1,911.9 Mt/a (in 2021)

As a rule of thumb, stainless steels cost four to five times much as carbon steel in material costs



STAINLESS STEEL SLAG

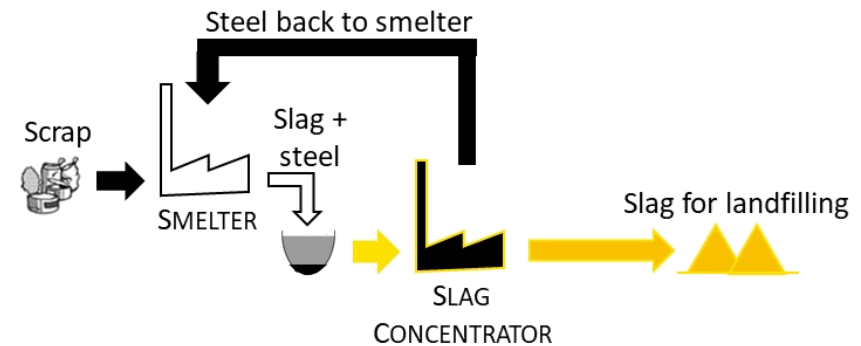
- Stone or powder-like by-products left over after a desired metal has been smelted from its raw material amounting to one third of steel
- Tasks of the slags in steel melting shop:
 - Formed by adding lime, which removes excess elements from steel
 - Assist in the temperature control
 - Minimize re-oxidation of the liquid metal
- Heterogeneous slag is caused by several steel grades, steel scrap as raw material, several parallel production lines, several unit processes, batch processing → Heterogenous slag production

Unit process	CaO (%)	SiO ₂ (%)	MgO (%)	Al ₂ O ₃ (%)	Cr ₂ O ₃ (%)	CaO+MgO/SiO ₂	Amount (kg/t steel)	Minor components
EAF	40...45	25...30	5...12	5...10	3...7	1.7...2.0	100...150	T, V, Ni oxides
AOD	55	25...30	5...10	1...5	0.5...1	2.5	100...120	CaF ₂
LF-CC	55...60	20...30	5...10	1...5	1...5	2.2...3	15...20	CaF ₂ , Ti, Nb, V

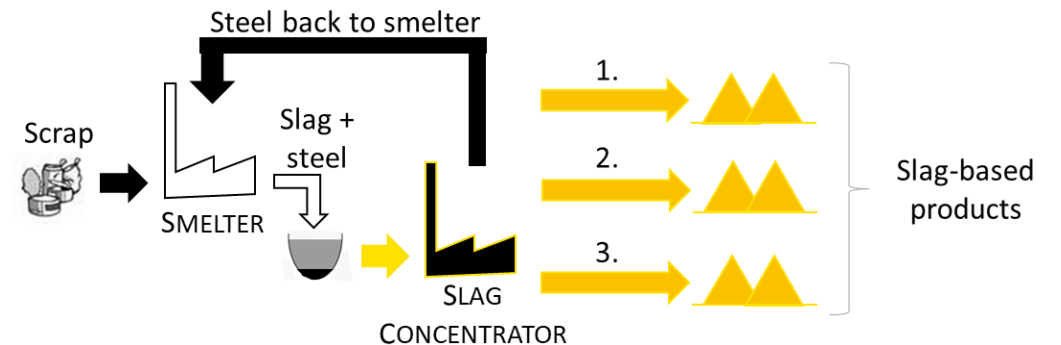


PRESENT SLAG PROCESSING AND SLAG-BASED PRODUCTS

- Slags contain metal some 10...15 % → Main target for slag processing is to recover metals and return them to the smelter as raw material
- Often slags are wet-ground, metallics are separated out and residual slag is landfilled



- Modular slag processing method by Tapojärvi
 - Metal separation is combined with the production of CE-marked slag-based products
 - Reduces landfilled slags
 - Products replace virgin natural resources





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