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TRIPLE Steelix Industrial Region 2.0

Influence of Deoxidation Practice on Non-Metallic Inclusion Distribution and their Effect on the Mechanical Properties of Low Alloy Steel.

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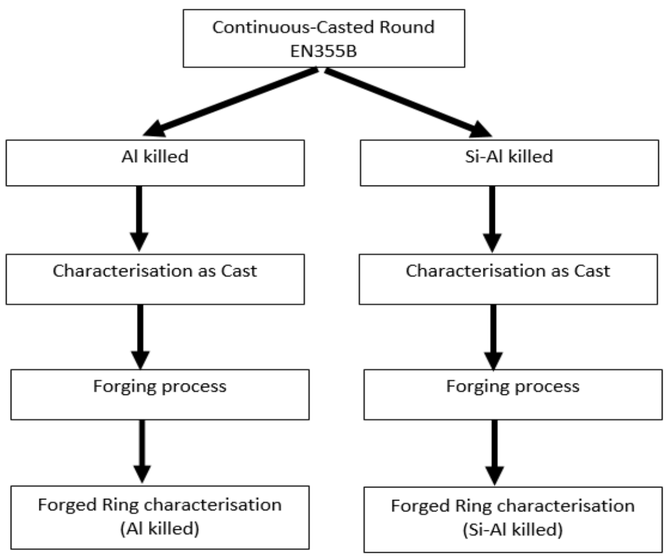
Aim of the project

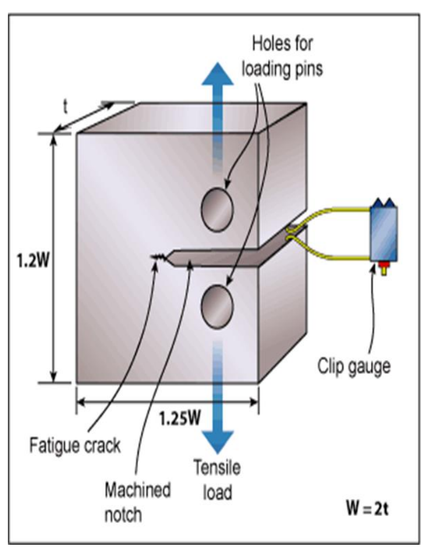
The aim of this research is to investigate the effect of deoxidation practice on the distribution of non-metallic inclusions in an as cast and a forged and rolled condition of a structural component.

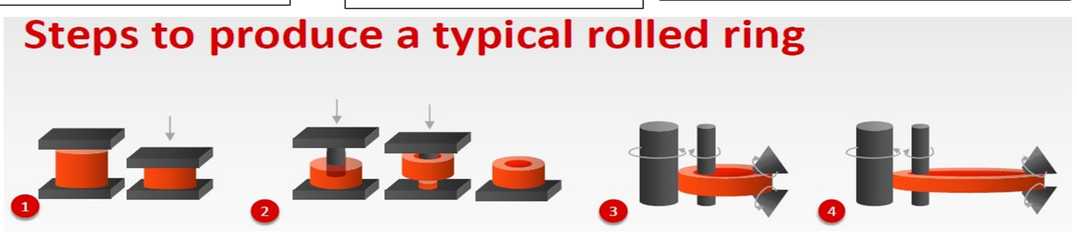
Methodology

The proposed methodology is divided into three stages:

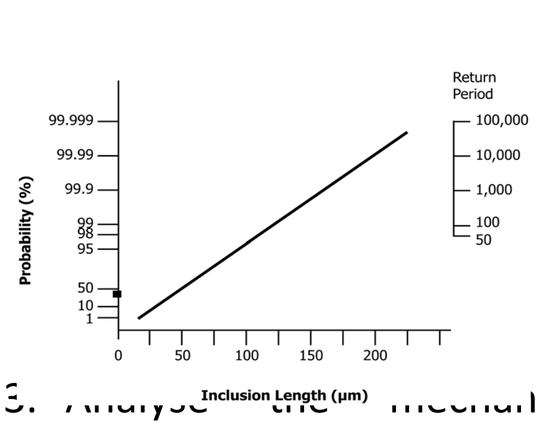
1. To determine which deoxidation practice, either using Al and/or Si-Al is more suitable by means of Automated Feature Analysis in the SEM.

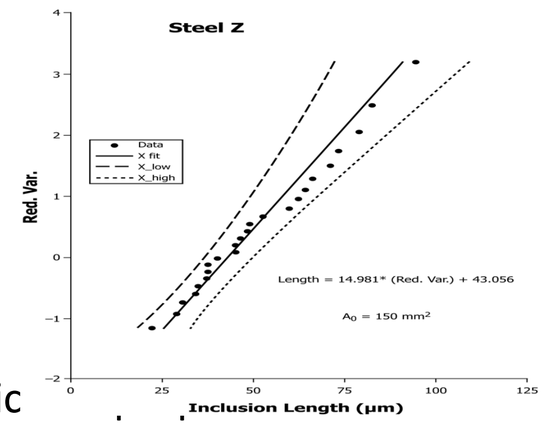




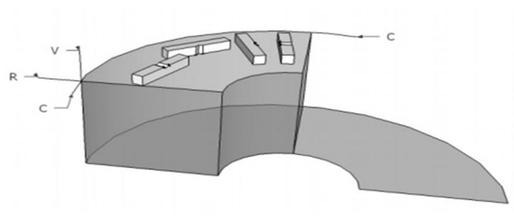


2. Based on this results carry on Extreme Value Statistical Analysis to estimate the largest inclusion size that can be obtained in order to compare different heats and deoxidation practice.





3. Analyse the mechanic[illegible] components, fabricated from different heats and deoxidation practice.

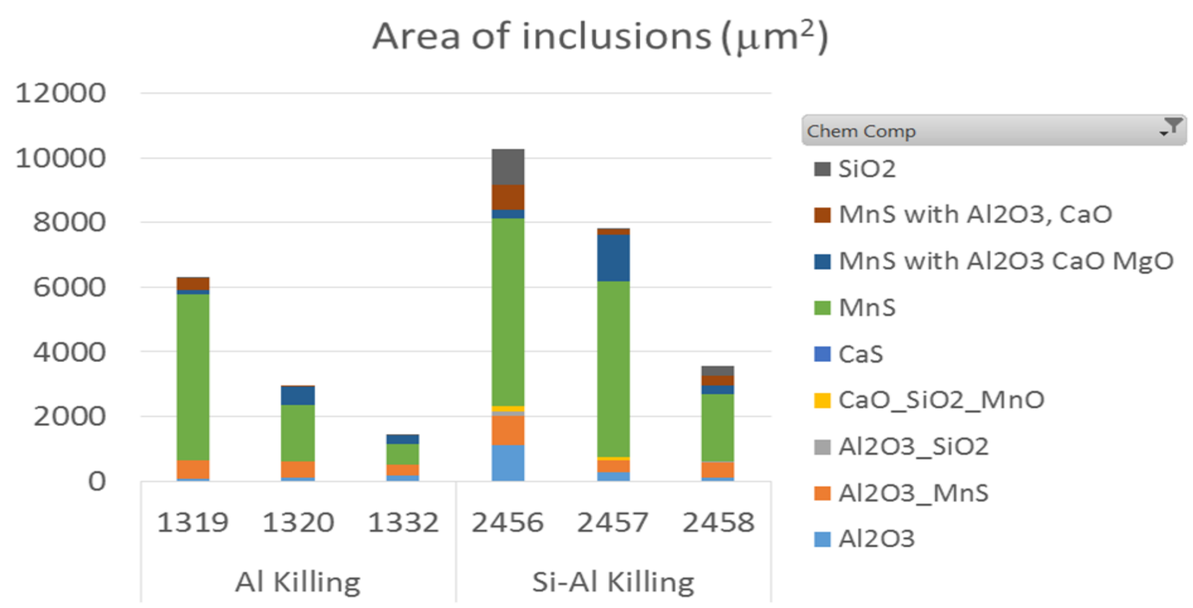


Results

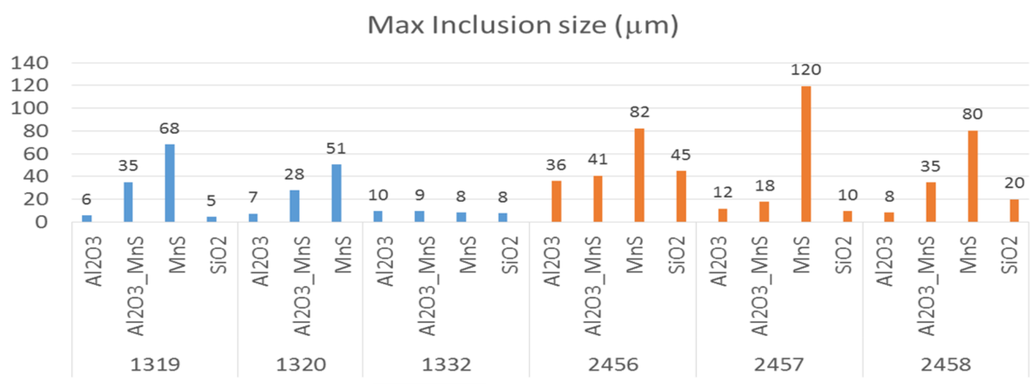
A table of AFA-SEM results from 3 different heats of each deoxidation practice:

	Sample ID	Number of inclusions	Inclusions / mm2	Area of inclusions	Inclusion Index
Al	1319	720	51.79	6315.43	0.0454
	1320	511	36.76	2940.83	0.0211
	1332	593	42.66	1445.94	0.0104
	Average	608	43.74	3567.40	0.0256
Si-Al	2456	878	63.16	10263.23	0.0738
	2457	608	43.74	7837.5	0.0563
	2458	460	33.09	3576	0.0257
	Average	649	46.66	7225.58	0.05193

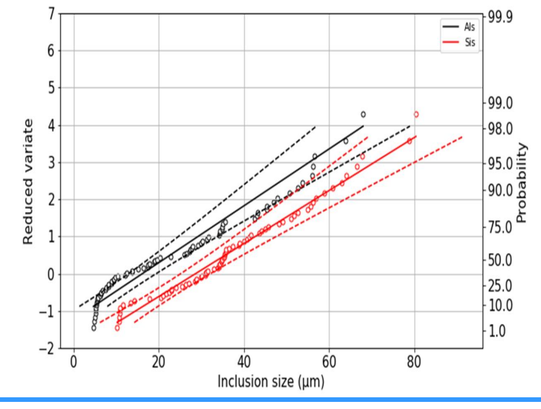
Area of Inclusions per each heat detected with AFA-SEM:



Max sizes per heat:



Extreme Value Comparison Al vs. Si-Al Steel:



Conclusions and Further work

1.-Careful control of Si-Al practice has the potential to achieve similar cleanliness level than Al in final product.
2.-Extreme Value Analysis, useful method to characterise inclusion distribution and compare different lots of steel.
3.-Evaluation of mechanical properties necessary to determine if large NMI are detrimental to performance.