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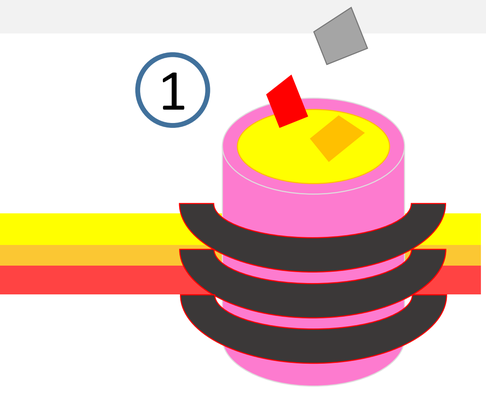
ABSTRACT

Improving the formability of Interstitial Free steels is the project's aim, and rapid alloy prototyping (RAP) is an effective way of tackling this endeavour. While examining the microstructure evolution, the idea is to roll out a 40 - 140g RAP DX57 cast in the mini hot and cold rolling mill and to have several Mini 2 & 1 bars fabricated and tensile tested for mechanical properties.

Elements such as Ti, Nb, and N are subject to manipulation to observe any promising notable effects on the steel's mechanical properties. If small-scale production of alloys, showing representative structures and realistic results from miniature specimens, could be achieved, this would represent a significant improvement and acceleration in novel steel-grade design.

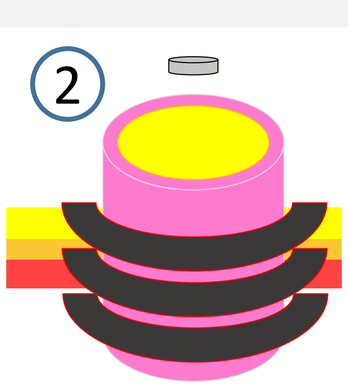
Development of Improved Formability Interstitial Free Steels

1



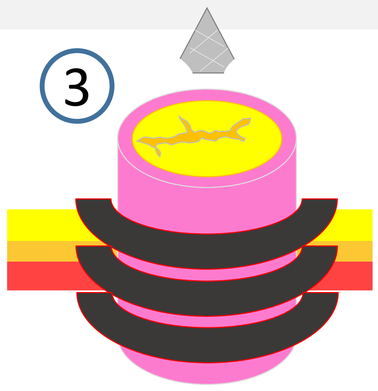
Melting all the **Fe flakes** within the 40g capacity crucible

2



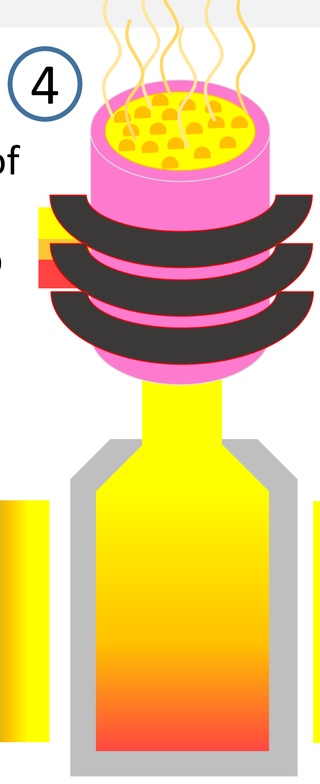
Excess **Al** is added to purge the oxygen

3



An **Al** foil package of **Ti and Mn-N** is added before drop casting in to the mould

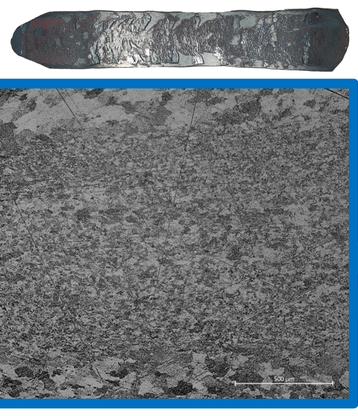
4



5

The average grain size of the **dropcast** of IF transfer bar material is **130µm**.

6



As-cast **hot rolled (HR). Entry and exit temperatures of 1130°C and 920°C.** The as-cast is reduced by 72% in one pass and then coiled at 710°C. The average grain size is **20µm**.

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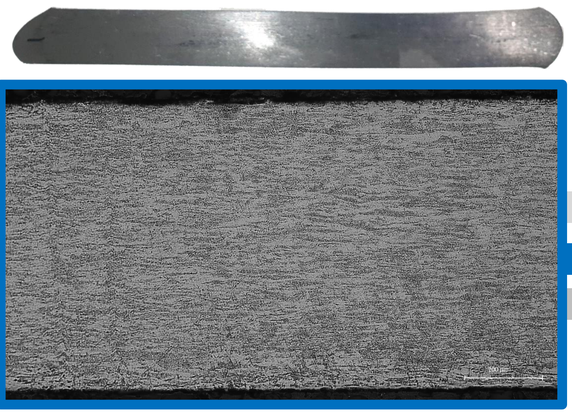
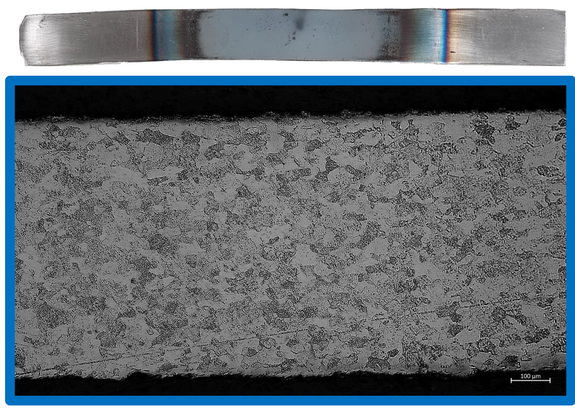


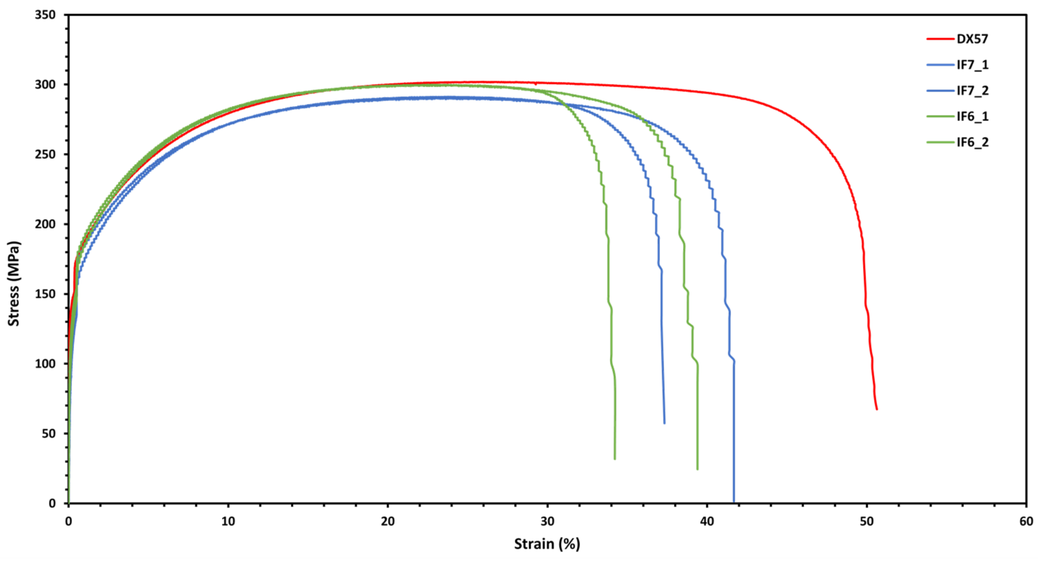
The coiled strip is then **cold rolled (CR)**. In three passes, the strip is reduced to a final gauge of ~0.8mm after experiencing a 60% reduction.

8

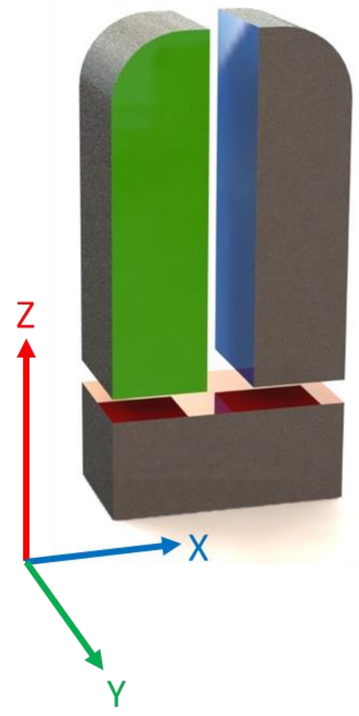


The CR strip is then **annealed** in the Gleeble following the Zodiac cycle. The average grain size of **43µm**.

9



Cut ASTM 25 bars from the annealed strip for tensile testing. Increasing the CR reduction by 13% from 60% increased the **r-value from 1.63 to 2.1.** A **73% CR** reduction is adequate to attain a sufficient {111} texture to support deep-drawability properties. The **tensile strength value is achieved using a 72% HR reduction**. With the same reduction, the young's modulus is closest to the target of product DX57.



	HR	CR	Gauge,a0(mm)	E(GPa)	Rp0.2(MPa)	Rm(MPa)	Ag(%)	A(%)	n(5-10%)	n(10-15%)	n(10-20%)	r20%
DX57	**89%**	**82%**	**0.81**	**201**	**142**	**299**	**26**	**51**	**0.269**	**0.253**	**0.248**	**2.01**
IF7	55%	73%	0.77	111	137	290	23	42	0.254	0.234	0.230	2.10
IF7	55%	73%	0.77	99	120	291	23	37	0.269	0.242	0.235	2.45
IF6	72%	60%	0.73	188	138	300	23	34	0.250	0.228	0.223	1.63
IF6	72%	60%	0.72	152	127	299	23	39	0.258	0.233	0.226	1.53

Acknowledgement

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