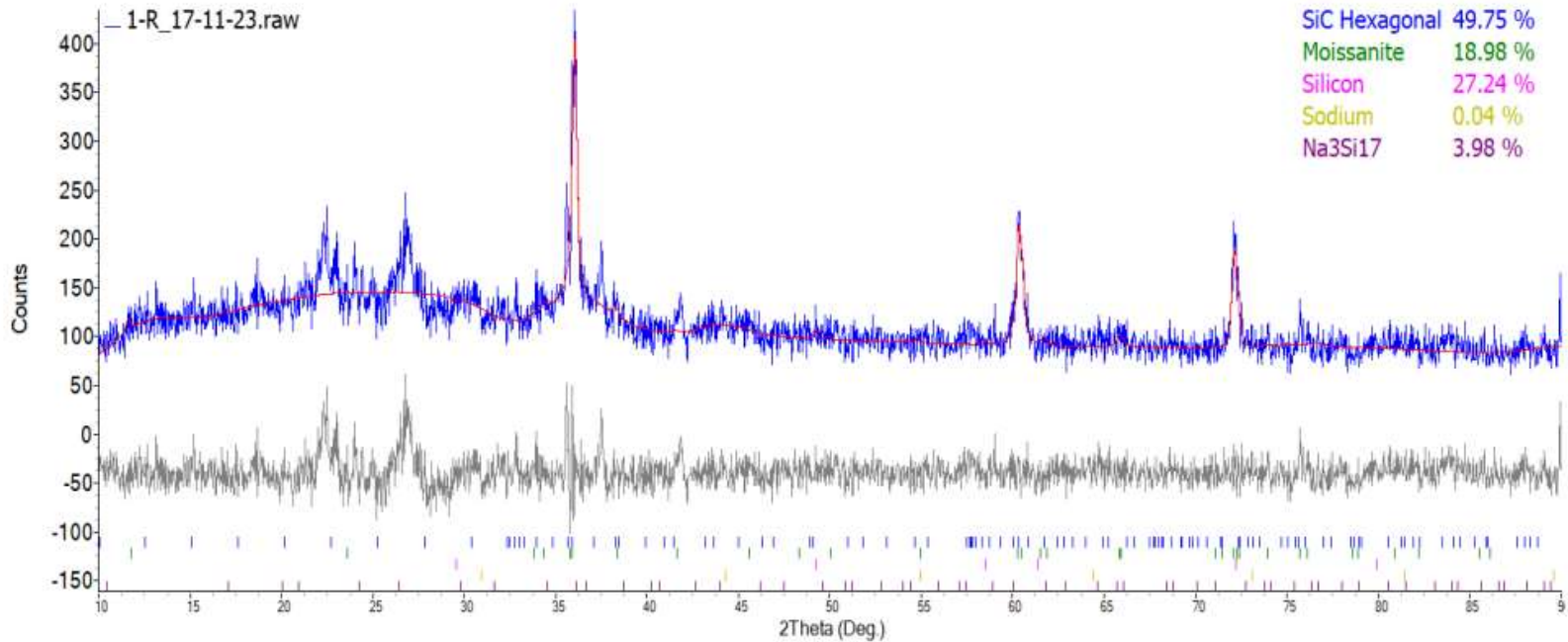


# Sodium Alloy [Si-Na-C]

1<sup>st</sup> of its kind metal  
pre-conditioner for iron & steel





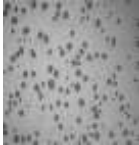
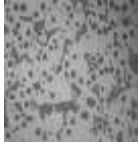
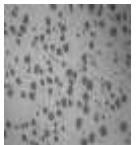
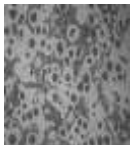
# Trial no. 1 – HEAD END COVER

## Trial no. 2 – FLYWHEEL

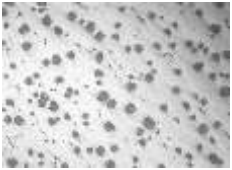
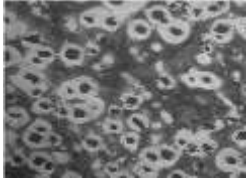
*Conducted in SG Iron at Shivamogga as a pre-conditioner*

<b>Trial Number</b>	<b>1st Trial</b>	<b>2nd Trial</b>
<b>Trial Process start Date</b>	22-06-2023	26-07-2023
<b>Trial Process End Date</b>	08-07-2023	05-10-2023
<b>Supplier Name</b>	NC Innovations P Ltd	NC Innovations P Ltd
<b>Supplier Raw materials details</b>	Si-Na-C pre-conditioner	Si-Na-C pre-conditioner
<b>Supplier Raw materials Quantities</b>	10Kg	7 KG
<b>Trial conducted Part Name</b>	Head End Cover	FLYWHEEL
<b>Quantities</b>	28Nos + Test Bar - 01 No + Test Cupon for Micro - 01 No + Spectro Chill - 01 No	06 Nos + Test Bar - 01 No + Test Cupon for Micro - 01 No + Spectro Chill - 01 No
<b>Heat Number</b>	F2 - 28Nos and F4 - 28Nos	F230726Z03/ F230726Z04
<b>Reason for New Trials</b>	To Improve Casting quality ( Microstructure )	To Improve Casting quality ( Microstructure )

# Trial# 1: Head End Cover – Ductile Iron

Trial no. 1 – HEAD END COVER			1 <sup>st</sup> TAP results		2 <sup>nd</sup> TAP results	
<b>Microstructure Results</b>	Grade:					
	<b>1025-12 CMS</b>		90% SPHERODIZATION	15% PEARLITE FREE FROM CARBIDE	90% SPHERODIZATION	20-25% PEARLITE FREE FROM CARBIDE
<b>Hardness Report</b>	BHN	<b>156-217</b>	<b>206-211</b>		<b>197</b>	
	Tensile Strength	<b>448 Mpa</b>	<b>492</b>		<b>533</b>	
<b>Mechanical Properties</b>	Yield Strength	<b>310 Mpa</b>	<b>380</b>		<b>384</b>	
	% Elongation	<b>12</b>	<b>22.45</b>		<b>20.47</b>	
<b>Quality</b>	1st Stage Inspection	As per customer Spec	No defects found		No defects found	
	2nd Stage Inspection	As per customer Spec	No defects found		No defects found	
	Final Stage Inspection	As per customer Spec	Awaiting		Awaiting	
	NDE Result - RT/UT/DP/VT	As per customer Spec	Not applicable		Not applicable	
	Proof Machining Feedback	Free from defects	Not applicable		Not applicable	
	Customer Feedback (M/c shop)	Free from defects	Machining completed		Machining completed	
			3	Mob: +91.98864.94441   E-mail: cn@metgroup.co.in		
				results found ok	results found ok	

# Trial# 2: Flywheel – Ductile Iron

Trial no. 2 – FLYWHEEL			1st TAP results	
<b>Microstructure Results</b>				
Grade : 500/7			85 - 90% Spherodization	50-55% Pearlite free from carbides
<b>Hardness Reort</b>	BHN	170-230	<b>185-205</b>	
<b>Mechanical Properties</b>	Tensile Strength	51 Kgf/mm <sup>2</sup>	<b>54.87</b>	
	Yield Strength	32.64 Kgf/mm <sup>2</sup>	<b>40.18</b>	
	% Elongation	7	15.85	
	1st Stage Inspection	As per customer Spec	OK	
	2nd Stage Inspection	As per customer Spec	OK	
	Final Stage Inspection	As per customer Spec	NA	
<b>Quality</b>	NDE Result - RT/UT/DP/VT	Free from defects	OK	
	Proof Machining Feedback	Free from defects	Machining completed	
	Customer Feedback (M/c shop)	Free from defects	results found ok	

# Trial# 3: As a Pre-Conditioner

*Conducted in SG Iron at Coimbatore as a pre-conditioner*

Sample	Code	C	Si	Mn	S	P
23M01	BT1	3.566	2.019	0.351	0.012	0.038
	AT1	3.427	2.331	0.405	0.01	0.044

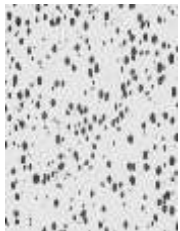
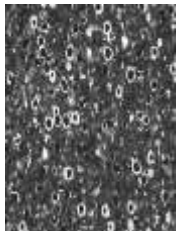
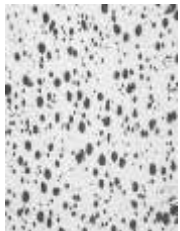
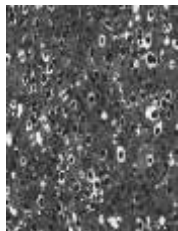


MI Metallurgy+ Sodium Alloy [Si-Na-C] TRIALS – COMPARISON			
Mechanical Properties	Spec	WITHOUT	WITH
Tensile Strength	600 N/mm <sup>2</sup>	666.3	694.98
Yield Strength	370 N/mm <sup>2</sup>	424	526.01
Elongation (%)	3% min	6.14	5.71
Nodularity	85% min	90%	90%
Pearlite	75% min	80-90%	80-90%
Ferrite	25% max	10-20%	10-20%
Hardness	229-269 BHN	229	229

# Trial# 3: As a Pre-Conditioner

*Conducted in SG Iron at Coimbatore as a pre-conditioner*

Na alloy [Si-Na-C] used as a melt additive in SG iron (DI)

[PSA Trial Details Metal Pre-Conditioner Sodium Comparison Report]

	TOP		MIDDLE		OD	
23M01 SAMPLE						

# Trial # 4: As an Inoculant

*Conducted in Cast Iron at Coimbatore as an inoculant*





Na alloy [Si-Na-C] used as an Inoculant

PARAMETERS	SPECIFICATION	SAMPLE (SODIUM)	REGULAR (ZIMEN)
C	3.25-3.35	3.270	3.297
Si	1.80-1.90	1.820	1.875
Mn	0.45-0.65	0.604	0.605
S	0.060-0.080	0.073	0.074
P	0.040-0.060	0.049	0.049
Cr	0.20-0.30	0.257	0.259
Cu	0.20MAX	0.124	0.125
INOCULANT NAME	-	SODIUM BASE	ZIMEN
T Liquidus(INO)	-	1183 °C	1188 °C
Te Min (INO)	-	1137 °C	1141 °C
T Solids (INO)	-	1093 °C	1097 °C
Rec (INO)	-	5.8	7.0
VPS (INO)	-	42	42
HypoEutectic Hyper (INO)	-	14	14
TAPPING TEMP °C	1420-1520 °C	1438°C	1436 °C
POURING TEMP °C	1370-1390 °C	1382	1386 °C
INOCULATION %	0.20%	0.20%	0.20%
INOCULATION WEIGHT	1.06 KG	1.06 KG	1.06 KG

# Trial # 4: As an Inoculant

*Conducted in Cast Iron at Coimbatore as an inoculant*

Na alloy [Si-Na-C] used as an Inoculant

PARAMETERS	SPECIFICATION	SAMPLE (SODIUM)	REGULAR (ZIMEN)
Polished	-		
Etched	-		
Type	Type A 90% +B&D 10%	<b>Type A 95% + B&amp;D 5%</b>	Type A 90% + B&D 10%
Size	4 ~ 6	<b>4 ~ 6</b>	4 ~ 6
Pearlite	90% Min	<b>98%</b>	98%
Ferrite	10% Max	<b>2%</b>	2%
Carbide	5% Max	<b>NIL</b>	NIL
Hardness	179-241 BHN	<b>197-207</b>	197-207
Tensile Strength	250 MIN	<b>253</b>	265



# Trial #5: As pre-conditioner

*Conducted in Cast Iron at Coimbatore as a pre-conditioner*

Na alloy [Si-Na-C] used as a melt additive in CAST IRON – Hydraulic Component



Micro inspection location

# Trial #5: As pre-conditioner

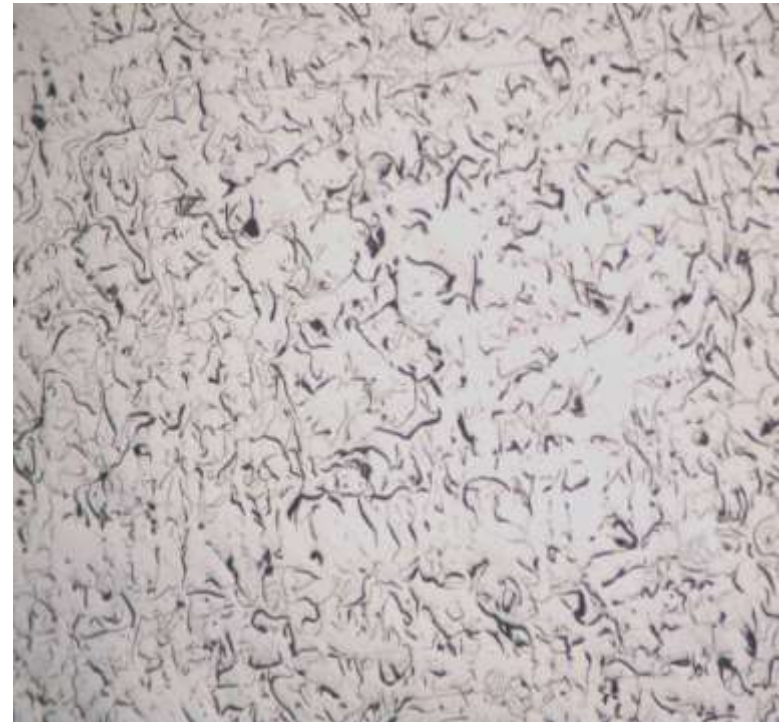
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*Conducted in Cast Iron at Coimbatore as a pre-conditioner*

Na alloy [Si-Na-C] used as a melt additive in CAST IRON – Hydraulic Component



**Micro structure Before Use**



**Micro structure After use**

# Conclusion

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The above results clearly show that there is considerable improvement in melt quality which is reflecting in improvements in mechanical properties and free from casting defects.

- The **elongation** is **almost doubled** which is very difficult to attain
- The **Tensile** strength **increased by 10-20%**
- The **Yield** Strength **increased by over 20 %**

Thus it is evidenced that sodium base melt additive and inoculant produce sound castings with the following improvements:

1. pressure tightness
2. reduction in oxidation loss
3. machinability
4. metallic slag inclusions
5. chilling & carbide issues
6. undesired microstructures and graphite distribution
7. mechanical properties
8. nodule count and nodularity in Du Iron
9. loss of alloys such as Cu, FeSiMg, FeSi due to oxidation