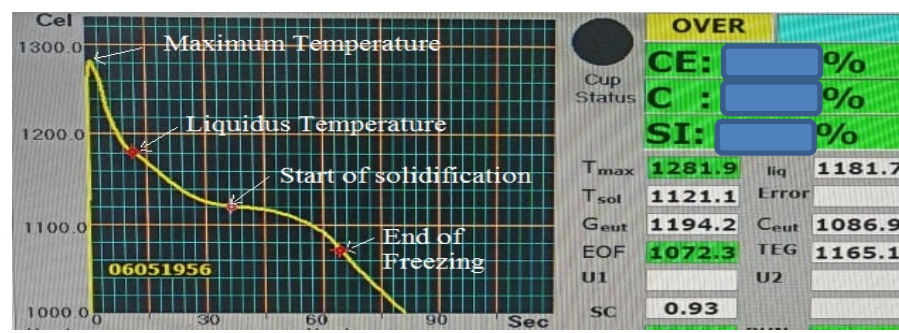
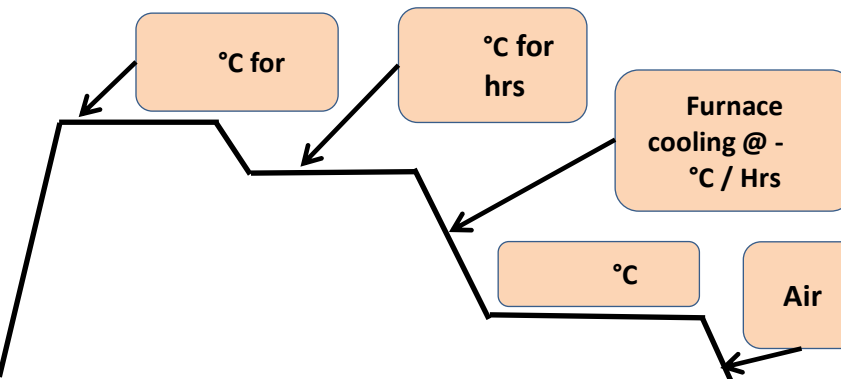
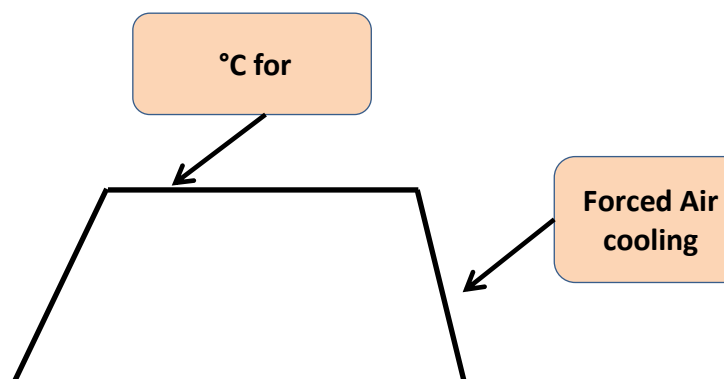
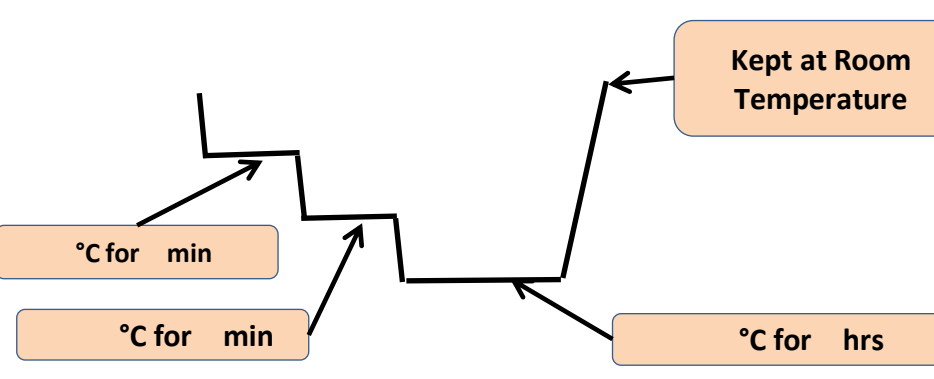
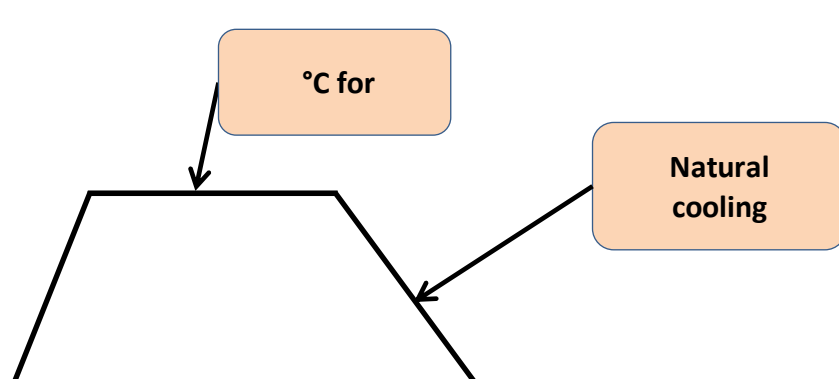
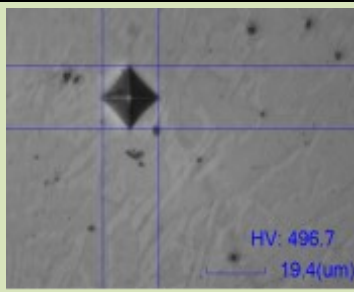
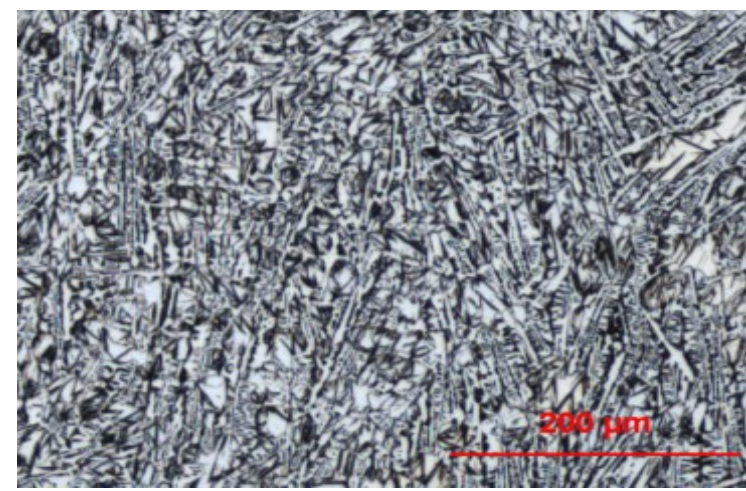
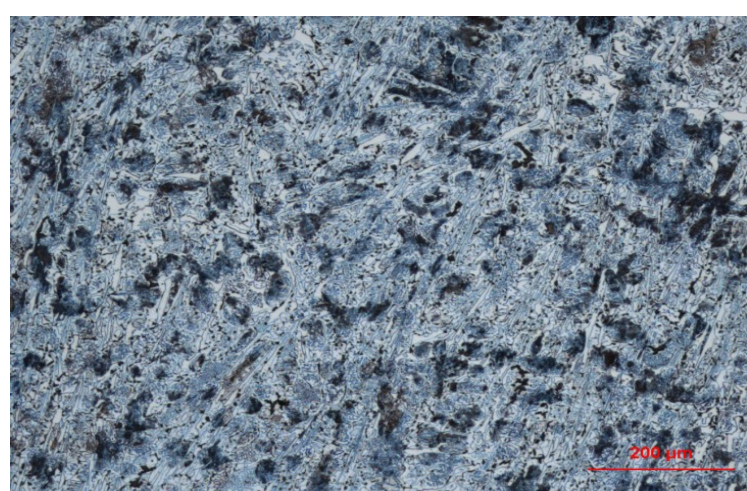
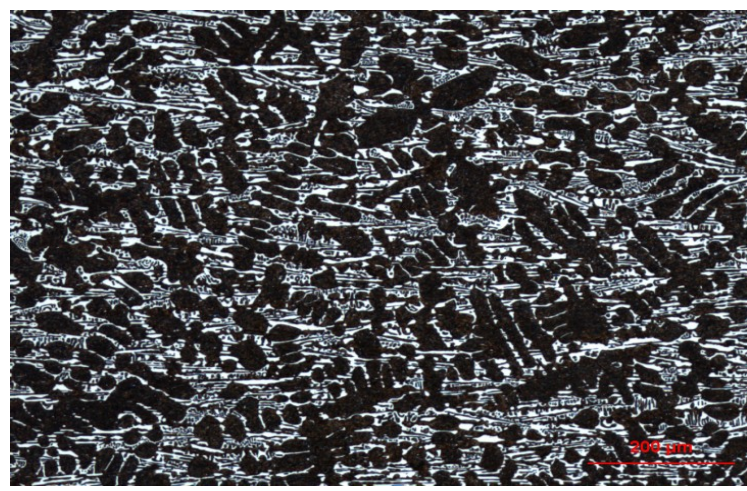
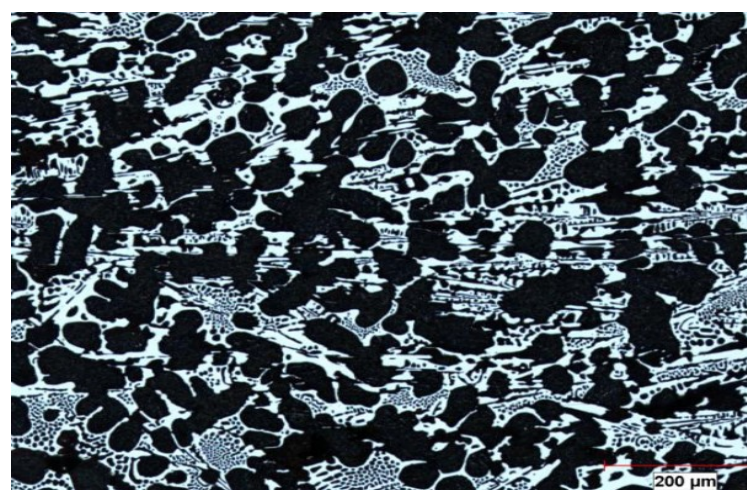
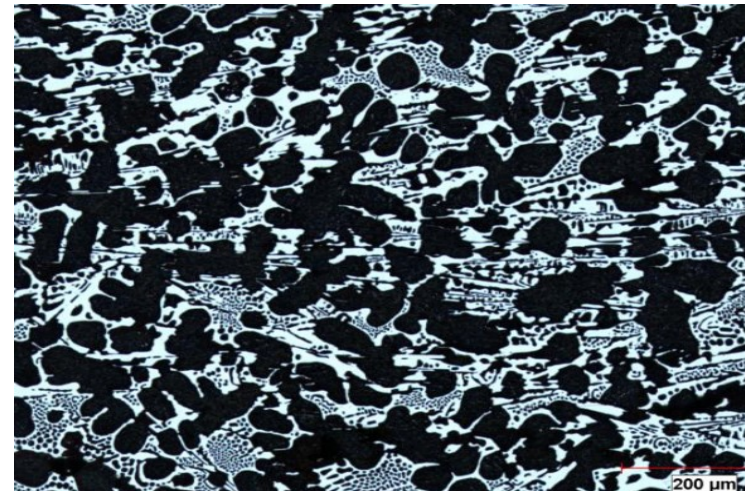
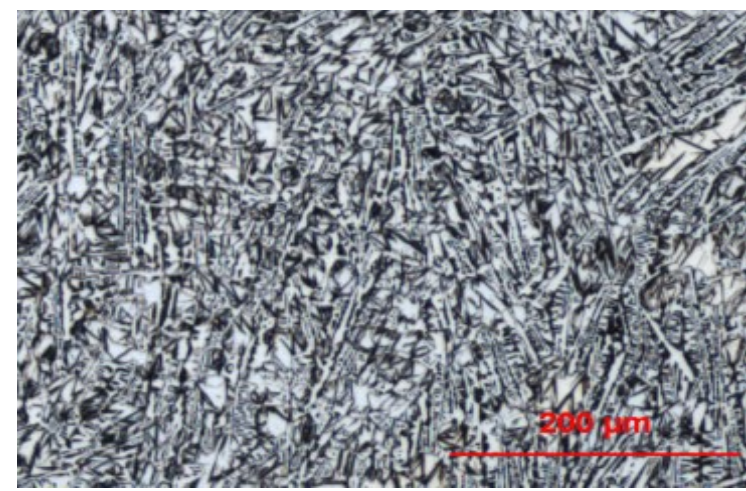
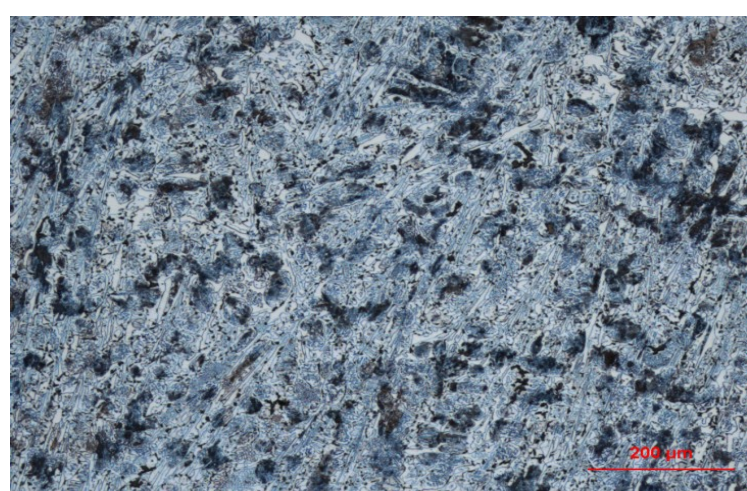
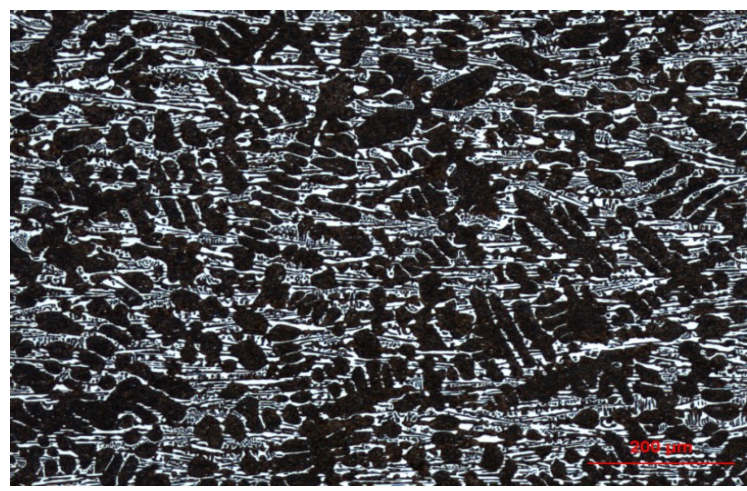
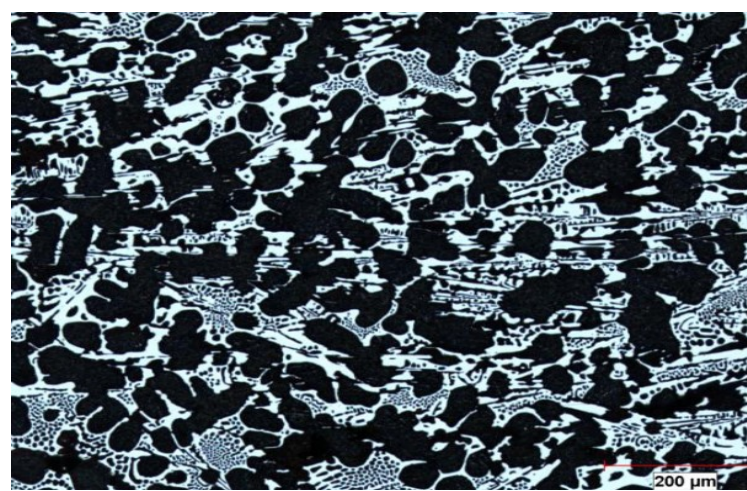
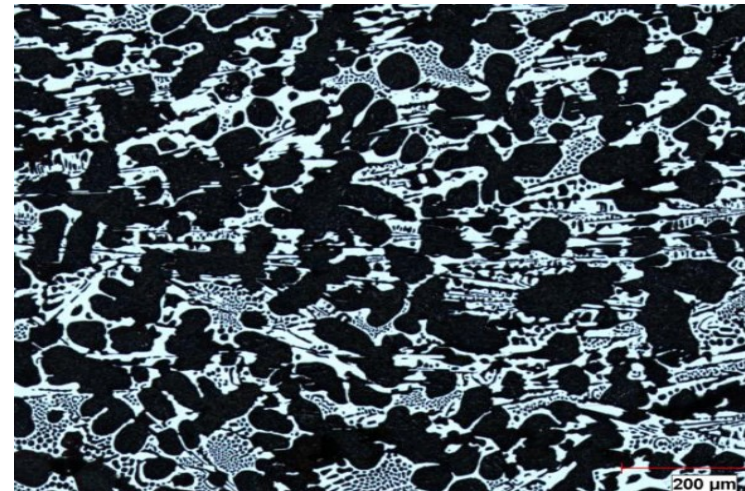
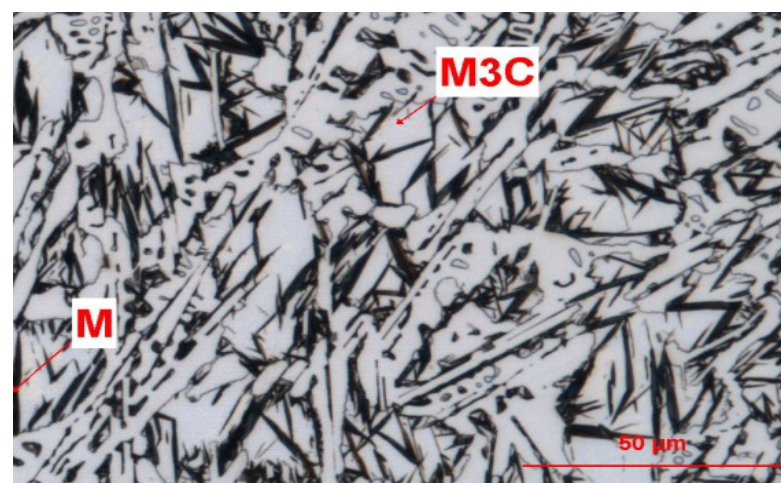
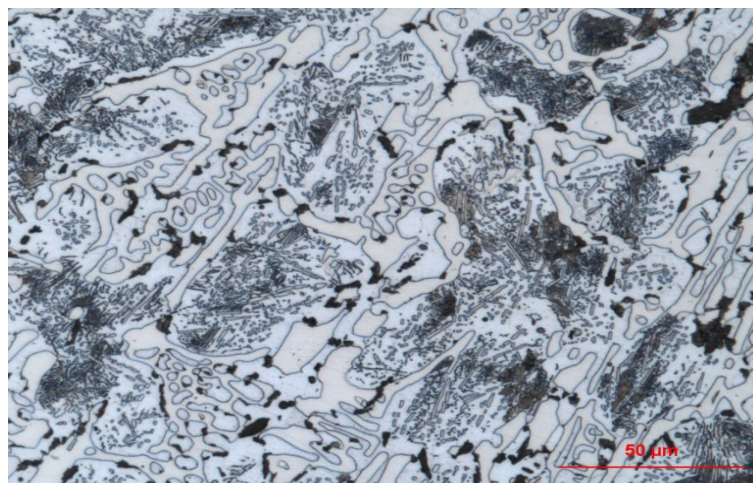
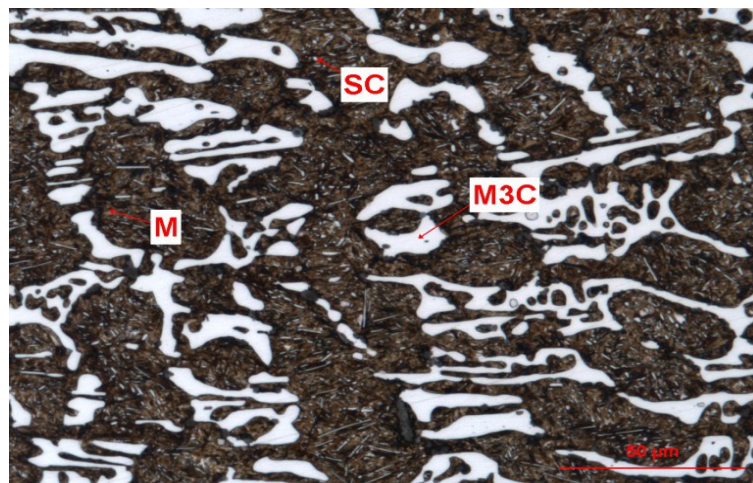
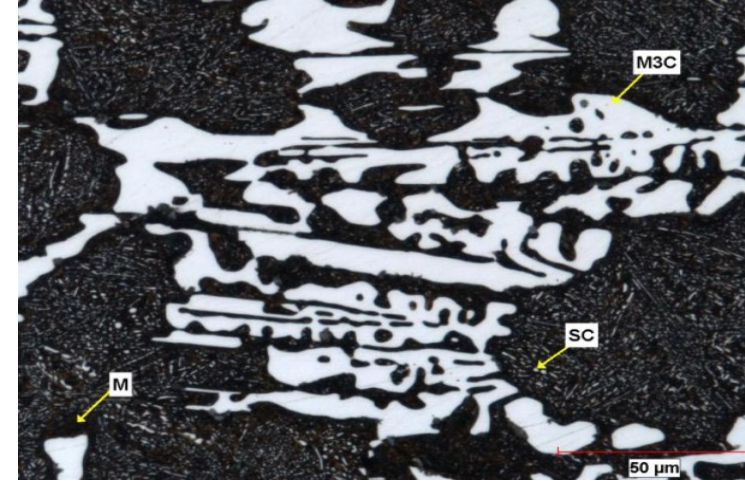
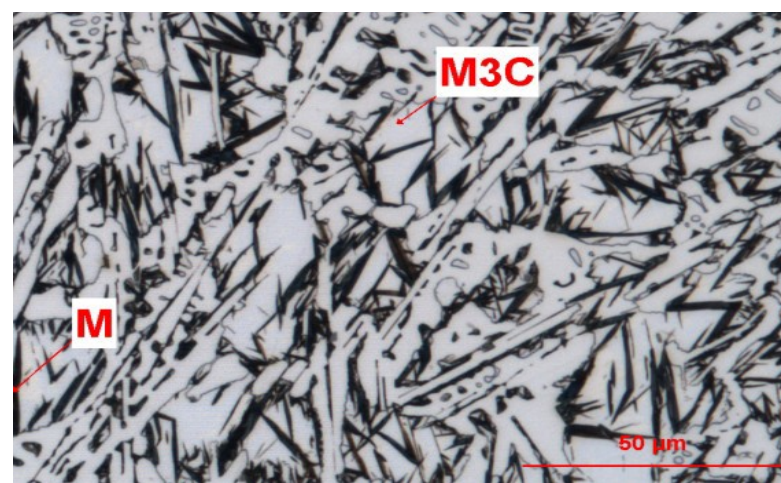
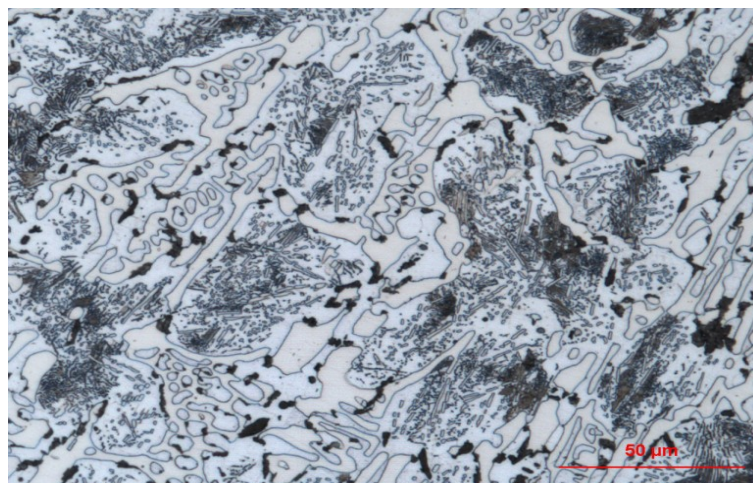
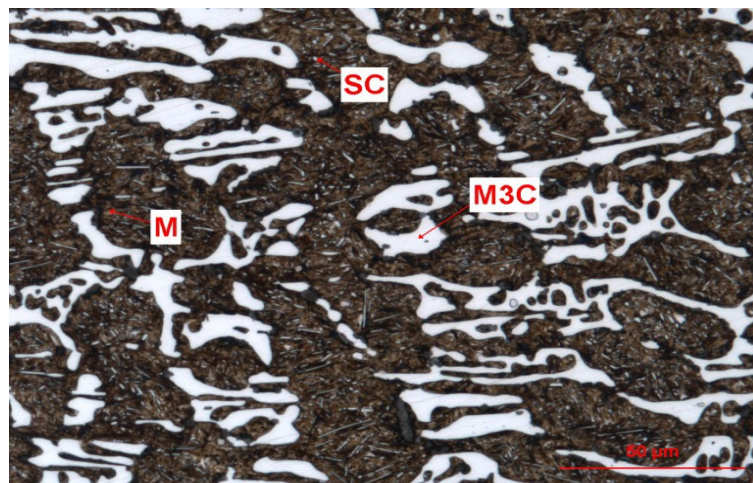
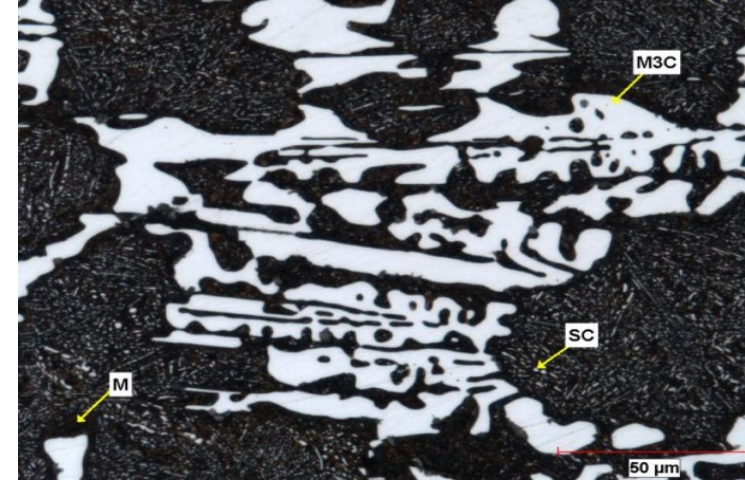
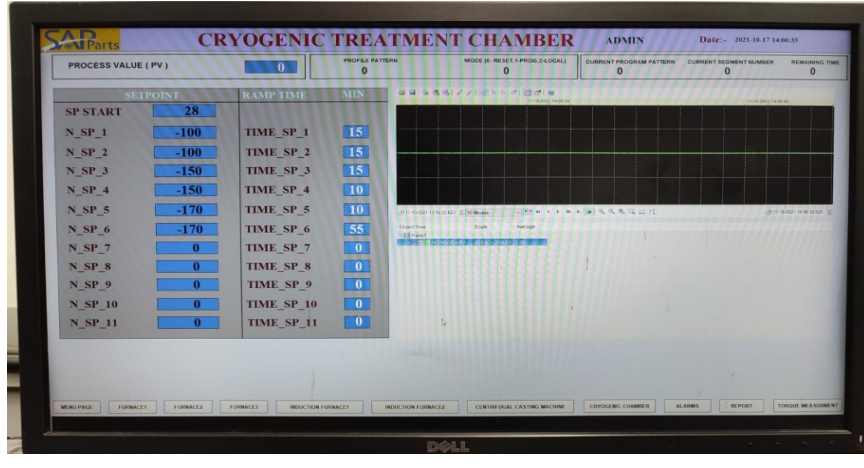
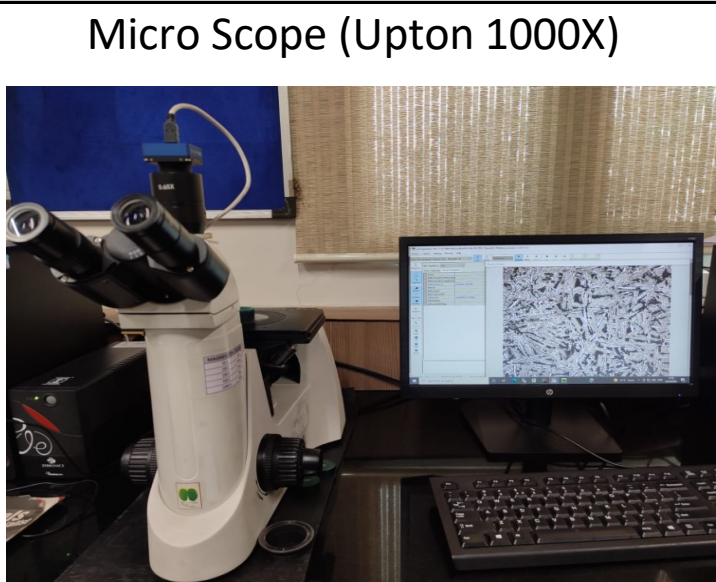
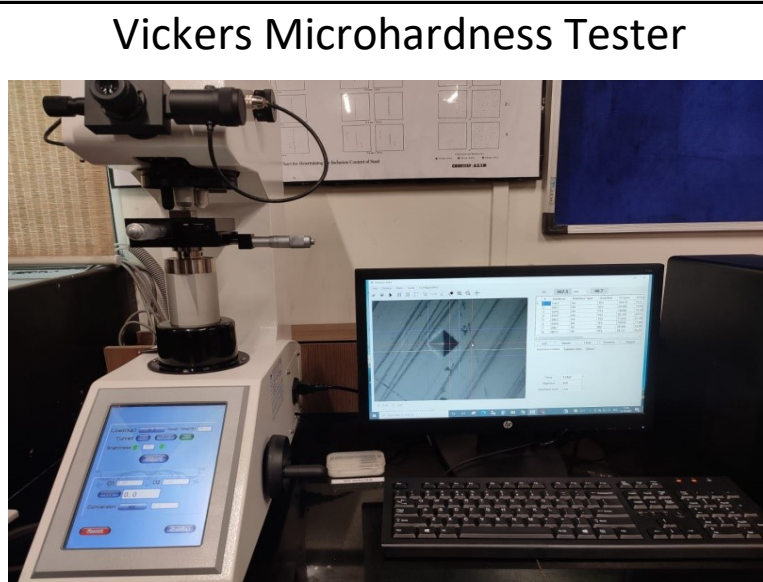
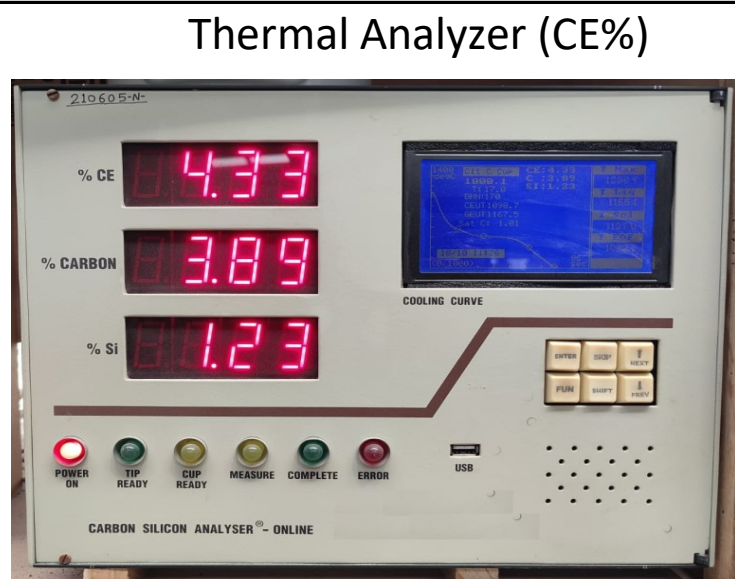


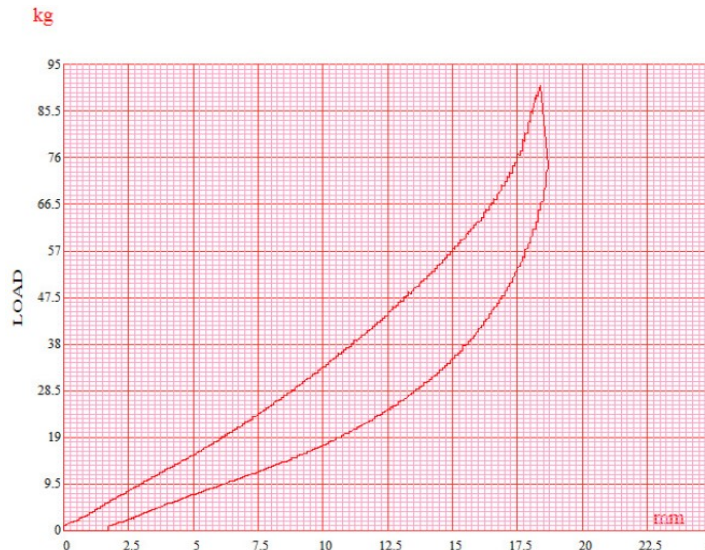
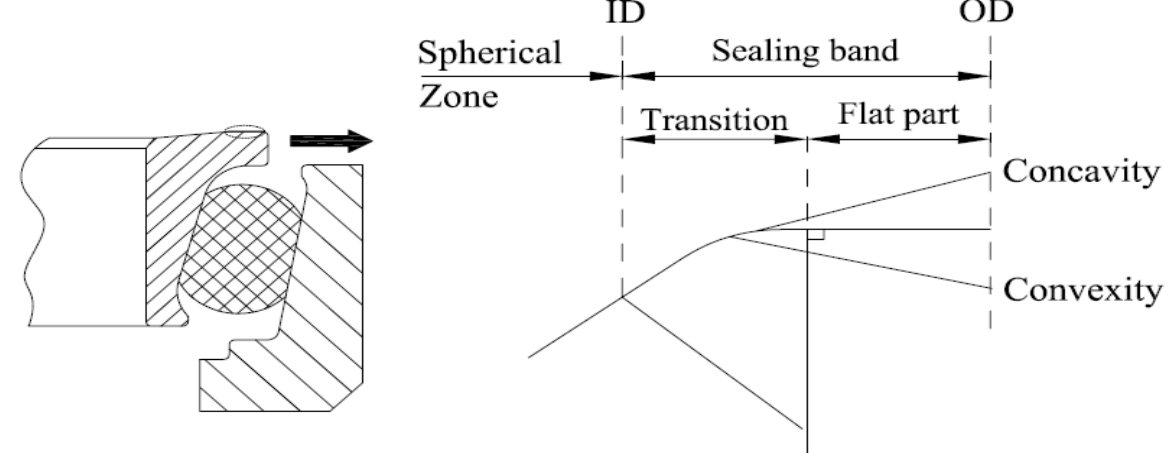
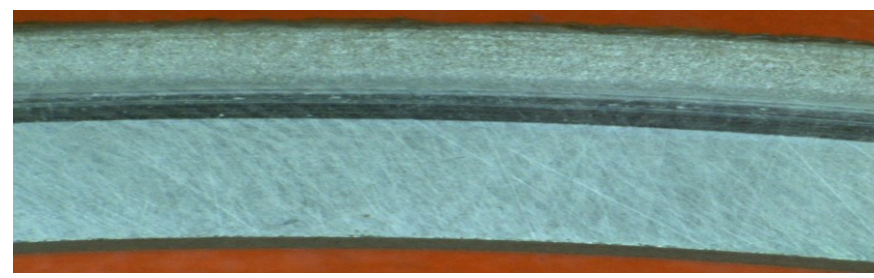
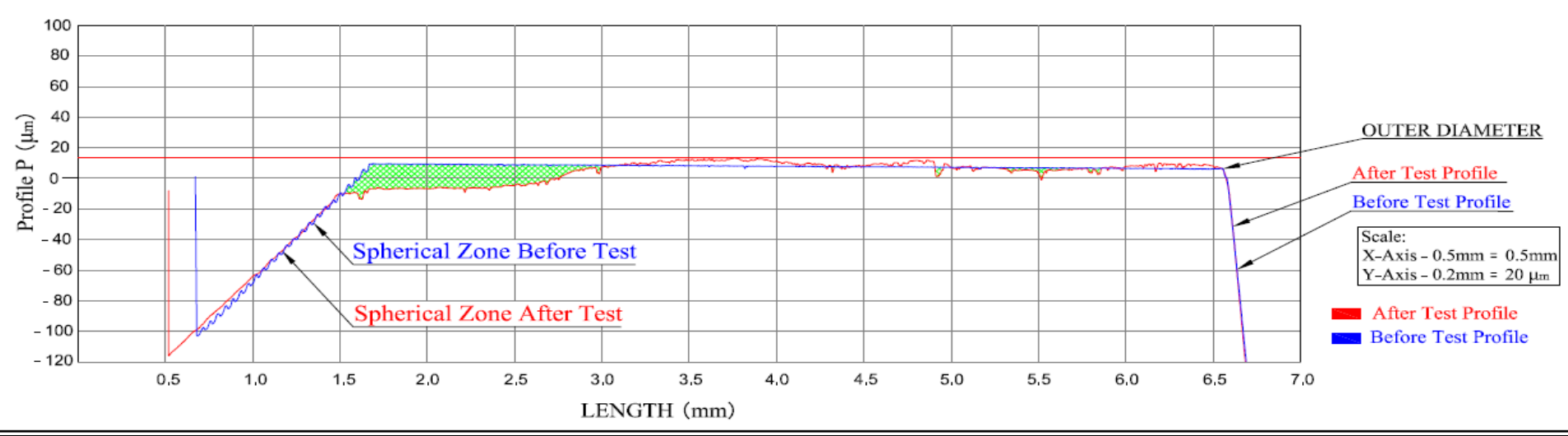
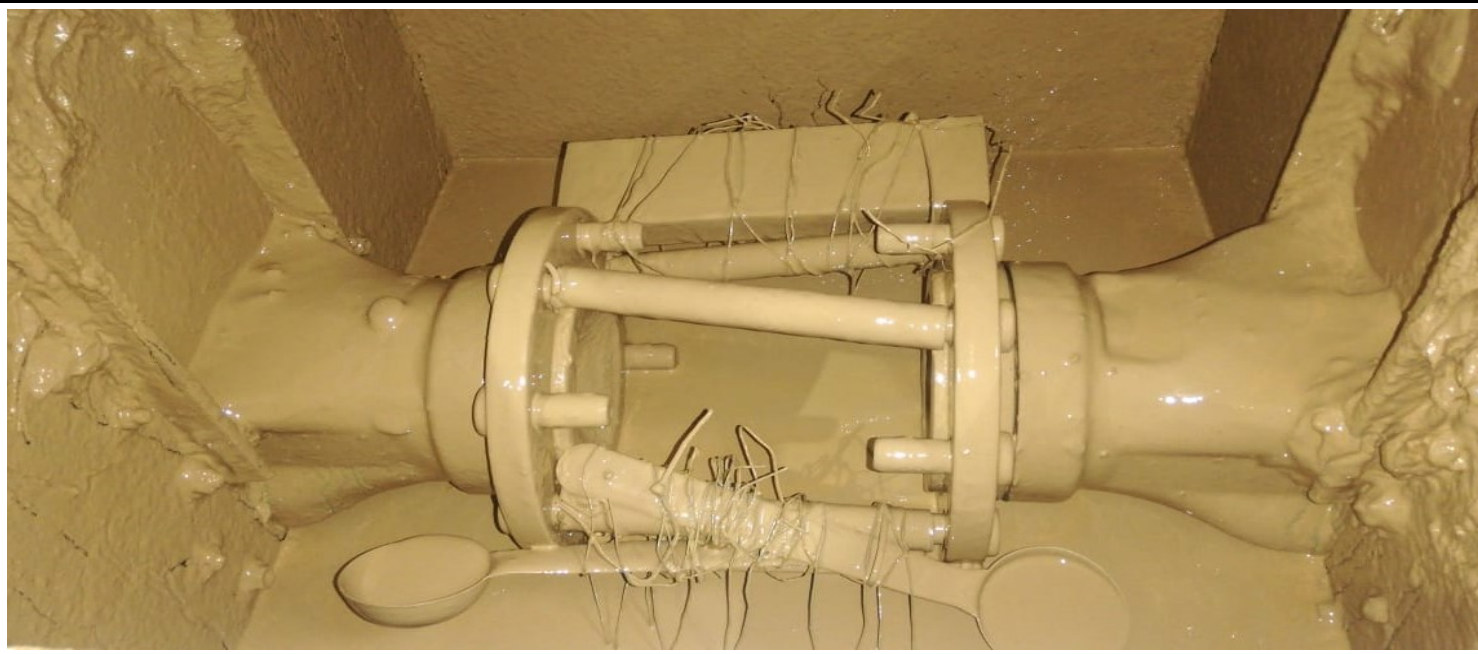
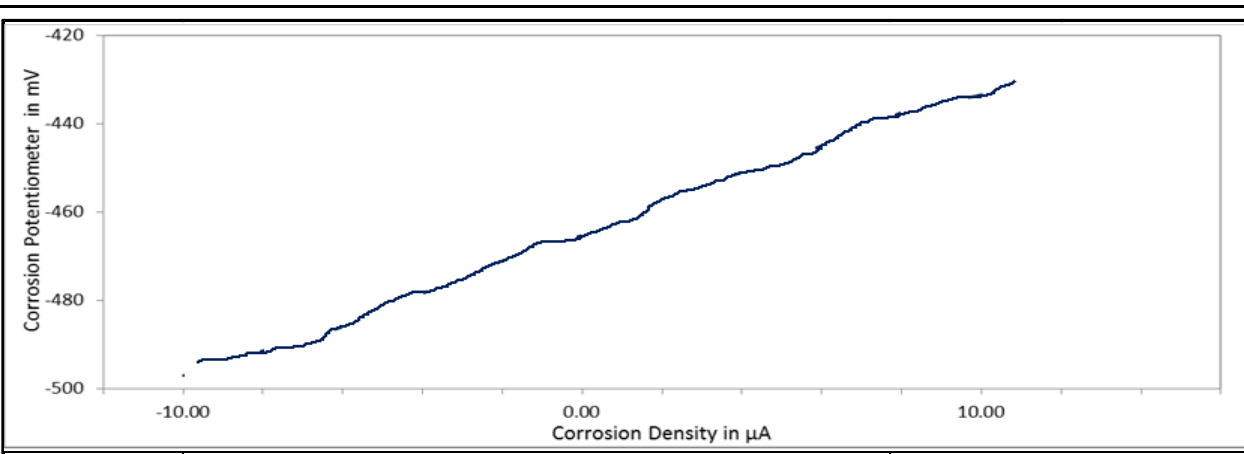
SAPParts MATERIAL PROCESS INFORMATION										
Material	Low Chromium-Nickel-Wear Resistance Cast Iron. Proprietary Composition equivalent to ASTM - A532/AA13532M -10 - Class I type A (Ni-Cr-Hc)								क्रस्नायस KrSnyas	
Composition (Elements)	C	Si	Mn	P	S	Cr	V	Mo	Ni	
Chemical Composition (%) Max.	3 - 3.6	0.4 - 0.7	0.3 - 0.9	0.3 max	0.1 max	1.2 - 1.7	0.3 - 0.6	0.4 max	3.5 - 4.3	
Process	Melting + Centrifugal Casting		De-stabilization		Hardening + Quenching		Cryogenic Treatment		Tempering	
Cycle	 *Solidification Curve for reference only									
Micro_Hardness in HV	 500 HV Min		450HV Max		650 HV Min.		650 HV Min.		650 HV Min	
Matrix	Martensite + Austenite + Carbides + Graphite		Martensite + Pearlite		Predominantly Martensite + Uniform Distribution of Carbide + Precipitation of secondary carbides		Transformation of retained austenite to martensite		Tempered martensite is formed	
Carbides Types	M ₃ C-Eutectic Carbides - 25% min		M ₃ C		M ₃ C		M ₃ C		Eutectic Carbides - 25% min & Secondary Carbides	
Graphite %	1% Max		1-4 % Max		1-4 % Max		1-4 % Max		1-4 % Max	
Micro structure Images @100X										
2% Nital Etching										
Micro structure images @500X										
2% Nital Etching										
Micro structure	The microstructure consists of Eutectic Carbide M ₃ C in interdendritic Structure with Austenite / Martensite Matrix.		The microstructure consists of Eutectic Carbide in interdendritic Structure with Austenite / Pearlitic Matrix.		The microstructure consists of Eutectic Carbide in interdendritic Structure with Martensite.		The secondary carbides precipitate in austenite, which promote the transformation of retained austenite to martensite.		The microstructure consists of Primary Eutectic Carbide, type M ₃ C - (25% min) in the matrix of Tempered Martensite with Secondary Carbides.	
Process Set up	Centrifugal Casting is done with Induction melting Furnace. Furnace is thyristor based and having infrared pyrometer. Robotic is used for molten metal pouring 		De-stabilization is done in Electric Bogie hearth Furnace. It has a PLC and HMI. 		Hardening is done in Induction Furnace. This furnace is connected SCADA and cycle is monitored. 		Cryogenic treatment is done in partition based cryogenic chamber. 		Tempering is done in Induction Furnace. This furnace has connected to SCADA and cycles are monitored on it. 	

Software Screen



Measuring Instruments



Process	Description	Remark																																																																																																																																																																							
Face Load		No neck formation																																																																																																																																																																							
Contact Mechanism		Area of contact is the transition zone																																																																																																																																																																							
PV Value	Stationary Seal Before 	- PV Value: Max 12.3 N/mm ² m/s																																																																																																																																																																							
	Stationary Seal After  Rotary Seal Before 																																																																																																																																																																								
Dust Ingress	Rotary seal After 	Elemental Analysis ASTM D 5185 2019																																																																																																																																																																							
	<table><tr><th colspan="3">Elemental Analysis by ICP-AES:</th><th colspan="3">ASTM D 5185 2018</th><th colspan="3">Elemental Analysis by ICP-AES:</th><th colspan="3">ASTM D 5185 2019</th></tr><tr><th rowspan="2">Sr.No.</th><th rowspan="2">Name of the Element</th><th rowspan="2">Observations</th><th rowspan="2">Sr.No.</th><th rowspan="2">Name of the Element</th><th rowspan="2">Observations</th><th rowspan="2">Sr.No.</th><th rowspan="2">Name of the Element</th><th rowspan="2">Observations</th><th rowspan="2">Sr.No.</th><th rowspan="2">Name of the Element</th><th rowspan="2">Observations</th></tr><tr></tr><tr><td>1</td><td>Aluminium content</td><td>1.8</td><td>13</td><td>Molybdenum Content</td><td>< 1</td><td>1</td><td>Aluminium content</td><td>1.8</td><td>13</td><td>Molybdenum Content</td><td>< 1</td></tr><tr><td>2</td><td>Barium Content</td><td>< 1</td><td>14</td><td>Nickel Content</td><td>< 1</td><td>2</td><td>Barium Content</td><td>< 1</td><td>14</td><td>Nickel Content</td><td>< 1</td></tr><tr><td>3</td><td>Boron Content</td><td>94</td><td>15</td><td>Phosphorus Content</td><td>1660</td><td>3</td><td>Boron Content</td><td>94</td><td>15</td><td>Phosphorus Content</td><td>1660</td></tr><tr><td>4</td><td>Calcium Content</td><td>3256</td><td>16</td><td>Potassium Content</td><td>2.1</td><td>4</td><td>Calcium Content</td><td>3256</td><td>16</td><td>Potassium Content</td><td>2.1</td></tr><tr><td>5</td><td>Cadmium Content</td><td>< 1</td><td>17</td><td>Sodium Content</td><td>< 1</td><td>5</td><td>Cadmium Content</td><td>< 1</td><td>17</td><td>Sodium Content</td><td>< 1</td></tr><tr><td>6</td><td>Chromium Content</td><td>< 1</td><td>18</td><td>Silver Content</td><td>< 1</td><td>6</td><td>Chromium Content</td><td>< 1</td><td>18</td><td>Silver Content</td><td>< 1</td></tr><tr><td>7</td><td>Copper Content</td><td>< 1</td><td>19</td><td>Tin Content</td><td>< 1</td><td>7</td><td>Copper Content</td><td>< 1</td><td>19</td><td>Tin Content</td><td>< 1</td></tr><tr><td>8</td><td>Iron Content</td><td>2.4</td><td>20</td><td>Titanium Content</td><td>< 1</td><td>8</td><td>Iron Content</td><td>2.4</td><td>20</td><td>Titanium Content</td><td>< 1</td></tr><tr><td>9</td><td>Lead Content</td><td>< 1</td><td>21</td><td>Vanadium content</td><td>< 1</td><td>9</td><td>Lead Content</td><td>< 1</td><td>21</td><td>Vanadium content</td><td>< 1</td></tr><tr><td>10</td><td>Lithium Content</td><td>< 1</td><td>22</td><td>Zinc Content</td><td>1645</td><td>10</td><td>Lithium Content</td><td>< 1</td><td>22</td><td>Zinc Content</td><td>1645</td></tr><tr><td>11</td><td>Magnesium Content</td><td>12</td><td>23</td><td>Silicon Content</td><td>6.7</td><td>11</td><td>Magnesium Content</td><td>12</td><td>23</td><td>Silicon Content</td><td>6.7</td></tr><tr><td>12</td><td>Manganese Content</td><td>< 1</td><td></td><td></td><td></td><td>12</td><td>Manganese Content</td><td>< 1</td><td></td><td></td><td></td></tr></table>		Elemental Analysis by ICP-AES:			ASTM D 5185 2018			Elemental Analysis by ICP-AES:			ASTM D 5185 2019			Sr.No.	Name of the Element	Observations	Sr.No.	Name of the Element	Observations	Sr.No.	Name of the Element	Observations	Sr.No.	Name of the Element	Observations	1	Aluminium content	1.8	13	Molybdenum Content	< 1	1	Aluminium content	1.8	13	Molybdenum Content	< 1	2	Barium Content	< 1	14	Nickel Content	< 1	2	Barium Content	< 1	14	Nickel Content	< 1	3	Boron Content	94	15	Phosphorus Content	1660	3	Boron Content	94	15	Phosphorus Content	1660	4	Calcium Content	3256	16	Potassium Content	2.1	4	Calcium Content	3256	16	Potassium Content	2.1	5	Cadmium Content	< 1	17	Sodium Content	< 1	5	Cadmium Content	< 1	17	Sodium Content	< 1	6	Chromium Content	< 1	18	Silver Content	< 1	6	Chromium Content	< 1	18	Silver Content	< 1	7	Copper Content	< 1	19	Tin Content	< 1	7	Copper Content	< 1	19	Tin Content	< 1	8	Iron Content	2.4	20	Titanium Content	< 1	8	Iron Content	2.4	20	Titanium Content	< 1	9	Lead Content	< 1	21	Vanadium content	< 1	9	Lead Content	< 1	21	Vanadium content	< 1	10	Lithium Content	< 1	22	Zinc Content	1645	10	Lithium Content	< 1	22	Zinc Content	1645	11	Magnesium Content	12	23	Silicon Content	6.7	11	Magnesium Content	12	23	Silicon Content	6.7	12	Manganese Content	< 1				12	Manganese Content	< 1		
Elemental Analysis by ICP-AES:			ASTM D 5185 2018			Elemental Analysis by ICP-AES:			ASTM D 5185 2019																																																																																																																																																																
Sr.No.	Name of the Element	Observations	Sr.No.	Name of the Element	Observations	Sr.No.	Name of the Element	Observations	Sr.No.	Name of the Element	Observations																																																																																																																																																														
1	Aluminium content	1.8	13	Molybdenum Content	< 1	1	Aluminium content	1.8	13	Molybdenum Content	< 1																																																																																																																																																														
2	Barium Content	< 1	14	Nickel Content	< 1	2	Barium Content	< 1	14	Nickel Content	< 1																																																																																																																																																														
3	Boron Content	94	15	Phosphorus Content	1660	3	Boron Content	94	15	Phosphorus Content	1660																																																																																																																																																														
4	Calcium Content	3256	16	Potassium Content	2.1	4	Calcium Content	3256	16	Potassium Content	2.1																																																																																																																																																														
5	Cadmium Content	< 1	17	Sodium Content	< 1	5	Cadmium Content	< 1	17	Sodium Content	< 1																																																																																																																																																														
6	Chromium Content	< 1	18	Silver Content	< 1	6	Chromium Content	< 1	18	Silver Content	< 1																																																																																																																																																														
7	Copper Content	< 1	19	Tin Content	< 1	7	Copper Content	< 1	19	Tin Content	< 1																																																																																																																																																														
8	Iron Content	2.4	20	Titanium Content	< 1	8	Iron Content	2.4	20	Titanium Content	< 1																																																																																																																																																														
9	Lead Content	< 1	21	Vanadium content	< 1	9	Lead Content	< 1	21	Vanadium content	< 1																																																																																																																																																														
10	Lithium Content	< 1	22	Zinc Content	1645	10	Lithium Content	< 1	22	Zinc Content	1645																																																																																																																																																														
11	Magnesium Content	12	23	Silicon Content	6.7	11	Magnesium Content	12	23	Silicon Content	6.7																																																																																																																																																														
12	Manganese Content	< 1				12	Manganese Content	< 1																																																																																																																																																																	
Wear Profile Analysis		Green hatching is the wear portion of seal ring																																																																																																																																																																							
Abrasion Test		Abrasive Content: 5% Silicon carbide (25 micron) and 5% Aluminium oxide (3 micron) of total lapping oil Machine Parameters: Face pressure on sample of 1.8 N/mm ² , Speed of machine 0.5-2 m/s & Abrasion flow rate 1-1.5 LPM																																																																																																																																																																							
Corrosion Resistance	 <table><tr><th>Sr. No.</th><th>Description</th><th>Result</th></tr><tr><td>1</td><td>Test Solution</td><td>0.5M of H2SO4</td></tr><tr><td>2</td><td>Surface Area of sample in cm^2</td><td>0.943</td></tr><tr><td>3</td><td>Equivalent Weight for Fe based sample</td><td>27.92</td></tr><tr><td>4</td><td>Density of Fe in g/cm^3</td><td>7.874</td></tr><tr><td>5</td><td>Corrosion Potential at 5 min (mv)</td><td>-470.1</td></tr><tr><td>6</td><td>Corrosion Potential at 55 min (mv)</td><td>-433.5</td></tr><tr><td>7</td><td>E_{con}(mV)</td><td>-465.2</td></tr><tr><td>8</td><td>i_{con}(µA)</td><td>9.43</td></tr><tr><td>9</td><td>Polarisation Resistance (Rp) (Kohms)</td><td>2.715</td></tr><tr><td>10</td><td>Beta A(V/decade)</td><td>0.12</td></tr><tr><td>11</td><td>Beta C(V/decade)</td><td>0.12</td></tr><tr><td>12</td><td>Corrosion Rate(mpy)</td><td>4.58</td></tr></table>	Sr. No.	Description	Result	1	Test Solution	0.5M of H2SO4	2	Surface Area of sample in cm^2	0.943	3	Equivalent Weight for Fe based sample	27.92	4	Density of Fe in g/cm^3	7.874	5	Corrosion Potential at 5 min (mv)	-470.1	6	Corrosion Potential at 55 min (mv)	-433.5	7	E _{con} (mV)	-465.2	8	i _{con} (µA)	9.43	9	Polarisation Resistance (Rp) (Kohms)	2.715	10	Beta A(V/decade)	0.12	11	Beta C(V/decade)	0.12	12	Corrosion Rate(mpy)	4.58	Corrosion Resistance by Potentiodynamic Polarization Resistance measurement ASTM G59-97 (Re 2014) Corrosion Rate: 4.58 mpy																																																																																																																																
Sr. No.	Description	Result																																																																																																																																																																							
1	Test Solution	0.5M of H2SO4																																																																																																																																																																							
2	Surface Area of sample in cm^2	0.943																																																																																																																																																																							
3	Equivalent Weight for Fe based sample	27.92																																																																																																																																																																							
4	Density of Fe in g/cm^3	7.874																																																																																																																																																																							
5	Corrosion Potential at 5 min (mv)	-470.1																																																																																																																																																																							
6	Corrosion Potential at 55 min (mv)	-433.5																																																																																																																																																																							
7	E _{con} (mV)	-465.2																																																																																																																																																																							
8	i _{con} (µA)	9.43																																																																																																																																																																							
9	Polarisation Resistance (Rp) (Kohms)	2.715																																																																																																																																																																							
10	Beta A(V/decade)	0.12																																																																																																																																																																							
11	Beta C(V/decade)	0.12																																																																																																																																																																							
12	Corrosion Rate(mpy)	4.58																																																																																																																																																																							