Materials abrasives wear and correlation with potential machinability

by

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To My Lovely
Mum & Dad

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Summary

Machinability of work piece materials is affecting the manufacturing cost significantly, increasingly advanced and durable materials typically exhibit a poorer machinability. One of the most significant mechanical properties affecting wear is the hardness of a material which is related to the abrasive wear. In the current work, a new research approach is tested in which various measurable characteristics of the materials are associated with the machinability.
The objective was to understand the relationship between hardness and abrasive wear and to characterization hardness variation in the material and determine the optimum load for the indents. Micro hardness measurements were applied for characterization the hardness variation in the materials, through normal distribution and histogram diagram. The results were applied in potentially abrasive wear formula. It was found that higher Wab values (potentially of abrasive wear) give a large flank wear.

Keywords: Machinability, Abrasive wear, Micro hardness

Contents

Introduction

In recent years, many innovative researches have been conducted to increase the producibility of the machining process, however, yet one of the key challenges in this field is to reduce the cutting tool wear. One of the most significant mechanical properties affecting wear is the hardness of a material (1). For instance the wear of the tool is rapidly increased when higher hardness steel is cutting (2).

The abrasive wear for some annealed pure metals and steels was observed to be linearly proportional to their hardness, although the wear resistance of steels after quenching and tempering with the same hardness is lower. Furthermore, the abrasive wear resistance does not vary much with increasing hardness by mechanical work hardening for some pure metals and heat treated steels (3).

Working materials behavior in metal cutting is generally referred to as the work material machinability. Machinability of work piece materials affects the manufacturing cost significantly. Increasingly advanced and durable materials typically exhibit a poorer machinability. New working materials require constantly changing needs of new cutting technology research and development. The current work tested a new research approach in which various measurable characteristics of the materials associated with machinability including a thorough systematic description of the polar diagram.

Aim of the project

The aim of the research presented in this thesis is to develop a method for measuring the hardness variations in material, through micro and macro indentation hardness measurements and analyzing the response it would have on potential machinability. The objective of this thesis work is to characterize of hardness variations in material and their effect on abrasive wear in machining. The hypothesis is that the working materials have an average hardness and hardness variations in the material affect the abrasive wear.

Objectives

- Characterization of hardness variation in the material.
- Determine the optimum load to use in the micro hardness measurement.
- Determine the sensitivity with the chosen load for the indent has any effect on position of the material.
- Hardness variation and its effect on abrasive wear.

Final goal

- To understand the relationship between hardness and machinability

1. Theory

1.1 Hardness testing

Hardness is a measurement of the material´s resistance to deformation and for metals is measured of their resistance to permanent or plastic deformation. Three types of hardness measurements could be tested. These are scratch hardness, indentation hardness and rebounded, or dynamic, hardness. Indentation hardness is engineering interest for metals. The hardness of a metal is measured by forcing an indenter into the surface of the material (4). Indentation hardness testing could be defined by Macro, Micro, and Nano hardness testing. 1kg to 50 kg load for Macro hardness testing, 1g to 1 kg load for Micro hardness testing and for Nano hardness testing less than 1g load are applied (5).

1.1.1 Macro Hardness testing

Macro hardness testing measurements are done quick and simple for achieving mechanical property data for the bulk material from a small sample. Three types of tests uses by the metal industry with accuracy. These are Brinell, Rockwell and Vickers hardness test. The way for determination of the hardness is the metal resistance to the penetration of a cone or none deformable ball. The test determines the depth of the ball or cone that slinked into the metals under a given load within a specific period of time.

The general hardness test methods are the followings:

1. Rockwell hardness test
2. Brinell hardness
3. Vickers
4. Knoop hardness
5. Shore

In this study, Vickers is used for both macro and micro hardness test, this method is defined in next section.

When material have a fine microstructure, multiphase and non homogeneous macro hardness will have highly variable data. In these cases it is appropriate to use micro hardness test (6).

1.1.2 Micro-hardness testing

Many problems in metallurgy need to determination of hardness over each phase, such as:

- Hardness gradient on a carburized surface
- Hardness of individual constituents of a microstructure

Or in this thesis work, characterization of hardness variations in material and its effect on the abrasive wear in machining.

The micro hardness test has usually static indentations, having less than 1 (kilogram-force). The Vickers diamond pyramid or the knoop elongated diamond pyramid is used as the indenter. The process for testing is alike the standard Vickers hardness test but it is done on a higher precision microscopic scale. In this thesis work the Vickers indenter is used.

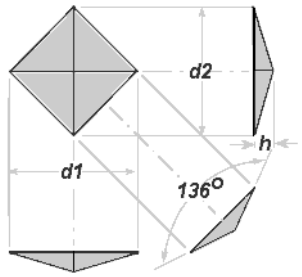


Fig 1.1 Vickers Pyramid Diamond Indenter Indentations (4)

The Vickers Diamond Pyramid hardness number can be determined by the applied load (kgf) divided by the unrecovered projected area of the indentation (7).

(1)

Where:

F = Load in kgf

d = Arithmetic mean of the two diagonals, d1 and d2 in mm

HV = Vickers hardness

The Vickers Diamond Pyramid indenter is a squared pyramid with the angle of 136^{o} between faces. The surface of the samples should be a metallographic finish; when the smaller load is used higher surface finished needed. Work hardening of the polished surface can influence the result, and for lower load usually less than 300g the small amount of elastic recovery is considerable. In addition with the small indentations generated at lower loads the error for measuring the actual end of the indentation is greater; hence gives a high hardness value, since with a decrease in load below 300g the hardness number is increased. Following Mechanical Metallurgy book the micro hardness test has been found more useful compare to the scratch hardness test (4).

1.2 Machinability

Machinability can be defined as how difficult or easy machining of a material into a finished product. Machinability is not an exact property; consequently it cannot be measured in terms

of absolute units. Despite the lack of a universal metric for the machinability, it may be evaluated by number of criteria such as:

Tool life: The amount of material removed by a tool before the tool performance becomes undesirable in a standard condition.

Surface finish: The surface finish attained under cutting condition

Chip shape: ‘’*The chip shape as it influences the clearance of the chips from around the tool, under standardized cutting condition*’’ (8).

Limiting rate of metal removal: Maximum rate of machining the material for a standard short tool life (8).

Cutting force: The forces applying on the tool, it can be measured by a dynamometer, or the power consumption.

At least, one of the above mentioned criteria is used when machinability has to be measured or determined. The tool life is used generally but choosing the above criteria is dependent on application and machining operation (9). Shaping of the new work surface is the most important goal of machining. By the movement and formation of the chip the main consumption of energy is occurred, therefore, the main economic and practical problems concerned with rate of metal removal and tool performance could be achieved by studying the performance of the work material that it is formed by chip and moves over the tool (8).

1.2.1 Tool wears geometry

Tool wear is the Changing of the tool’s shape during machining. The Flank wear appears on the clearance face for too high cutting speed on that area. Notch wear appears outside the depth of the cut when high temperature alloys and stainless steel are machined (10). Notch wear is appears outside the area of physical contact between tool and work piece for the reason of chemical reaction. The temperature at the flank wear is higher than the notch wear area (10).

1.3 Statistics of measurements

1.3.1 Normal distribution

In probability theory real-valued random variables that converge to a specific mean value are often approximated by normal distribution (a continuous probability distribution). The normal distribution is characterized by the mean (μ) and variance (σ2). Normal distribution could be calculated by following formula (12).

$$Y = \frac{1}{\sigma\sqrt{2\pi}} \exp\left(-\frac{(x-\mu)^2}{2\sigma^2}\right) \quad (2)$$

where x is a normal random variable, μ is the mean, σ is the standard deviation (13). The curve of the normal distribution is like a bell. The mean is at the middle of the curve and the sum of the area under the curve is equal to one (14).

For characterization of the hardness and showing the variation of it, in this report normal distribution diagram and histogram diagram are shown by SAS jmp 8.

1.3.2 Histogram

Histogram commonly used to plot density of data, density estimation and estimating the probability density function of the underlying variable. In other words ''*histogram is a graphic summary of variation in a set of data*'' (15). It categorize continues variable and gives a series of bars therefore it enable us to see diagram instead of seeing variation in a set of data in a simple table of numbers.

1.3.3 T-test

The means of two groups are compared by T-test. In other words when the means of two groups are statistically different from each other it could be assessed by T-test. Formula for the T-test is the differences between two means divided by measure of the variability. For measuring of the variability, the variance should be calculated for each group then should be divided by the number of data in the groups. Finally two values are added and their square root should be taken. One way analysis and T-test are mathematically equivalent (16).

1.4 Material

The materials studied in this thesis are SS2303 a ferritic stainless steel, SS 1672 ferrite – pearlit, SS2348 austenitic stainless steel, SAF2205 duplex stainless steel and Alloy 718 a nickel-iron based super alloy.

1.4.1 SS 2303

SS 2303 is a ferritic stainless steel alloy; it has 0.15wt % carbon content. It contains 12-14 wt % chromium hence SS2303 has a good corrosion resistance to air, steam, fresh water some alkaline solutions and other weak chemicals. When the metal is hardened and polished the best corrosion resistance is appeared (17).

SS 2303 has a good ductility in the annealed condition; in addition it can be hardened to 512HV which is the highest hardness of 12 percent chromium alloy. The typical applications of this alloy are axel, spiders, valve detail, pump details, piston rods faucets, agitators, knife blades, surgical instruments and shear blades (17).

The nominal composition for this alloy is given in table 1.1. Different names of this alloy in different standard systems are shown in table 1.2. Microstructure of SS 2303 is shown in fig 1.2.

Element	C	Mn	Si	P	S	Cr
Wt.%	0.15	1.00	1.00	0.040	0.030	12.0-14.0

Table 1.1: Nominal composition of SS2303 given in weight percentage [wt. %].

UNI	DIN	AFNOR	B.S	S.S.	AISI/SAE/ASTM
X20Cr13	X20Cr13	Z20C13	420S37	2303	420

Table 1.2: Type of steel

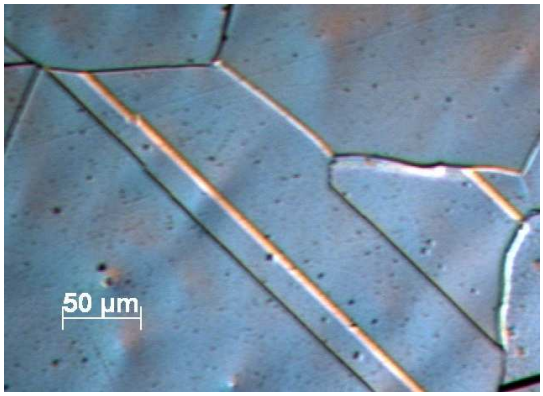


Fig 1.2 Microstructure of SS 2303 (annealed at 1050 ºC)

1.4.2 SS1672

SS1672 is a standard grade Carbon steel usually supplied in the black hot rolled or in the normalized condition. This alloy is characterized by good machinability, good strength and impact properties and reasonable weldability in the normalized or hot rolled condition. SS1672 is extensively used for applications need more strength and wear resistance than the low carbon steels in general. It is used in axles, bolts connecting rods, hydraulic clamps and rams, pins, studs, shafts, spindles etc (18). The nominal composition for this alloy is given in table 1.3. Different names of this alloy in different standard systems are shown in table 1.4 (19), (20). Microstructure of SS 1672 is shown in fig1.3. This alloy has been cold on a cooling bed.

Element	C	Mn	P	S	Si
Wt.%	0.43-0.50	0.60-0.90	0.04	0.05	0.10-0.35

Table 1.3: Nominal composition of SS1672 given in weight percentage [wt. %].

UNI	DIN	AFNOR	B.S	S.S.	AISI/SAE/ASTM
C46	CK45	2C45,XC45,XC42H1,XC48H1	080M46,060A47	1672	1045

Table1.4: Type of steel

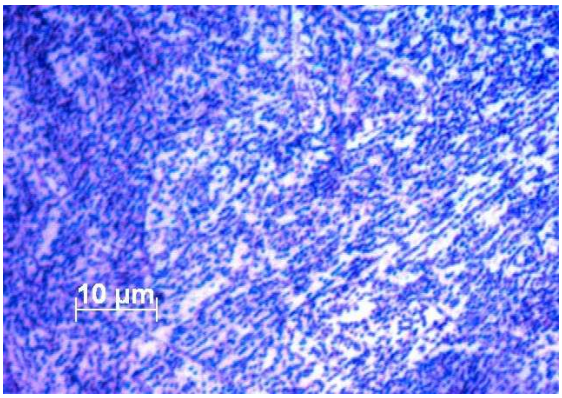


Fig 1.3 Microstructure of SS1672 (have been cold on a "cooling bed" direct after)

1.4.3 SS 2348

SS 2348 is the important alloy among the austenitic stainless steels alloy. Because of the molybdenum, it has good corrosion resistant properties, mainly higher resistance to crevice and pitting corrosion in chloride environments. This alloy has a low carbon hence it is protected from grain boundary carbide precipitation. Therefore SS 2348 is used in heavy gauge welded component widely. Because of the austenitic structure of this alloy it has excellent toughness (21). The microstructure of SS 2348 is shown in fig 1.4, this alloy has been annealed at 1050℃ .The nominal composition for SS2348 is given in table 1.5. Different names of this alloy in different standard systems are shown in table 1.6.

Element%	C%	Ni	Mo	N	Cr	Si	Mn	P	S	Co
Wt.%	0.017	10.20	2.11	0.057	16.83	0.50	1.50	0.028	0.028	0.086

Table 1.5: Nominal composition of SS2348 given in weight percentage [wt. %]

UNI	DIN	AFNOR	B.S	AISI/SAE/ASTM
X2CrNiMo17.12 GX2CrNiMo19.11	X2CrNiMo17132 X2CrNiMo17.12.2 GX2CrNiMo18.10	Z2CND17.12,Z2CND18.13 Z3CND17.11.02,Z3CND17.12.02FF Z3CND18.12.02,Z3CND18.12.03	316S11,316S13 316S14,316S31 316S42,;3156C12	316l

Table 1.6: Type of steel

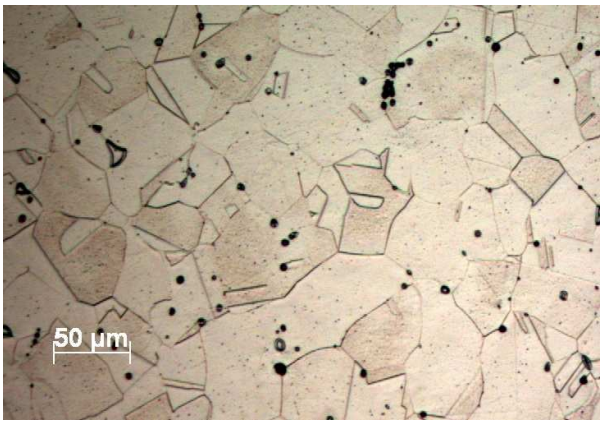


Fig 1.4 Microstructure of SS 2348 (annealed at 1050 ºC)

1.4.4 SAF 2205

SAF 2205 is a duplex stainless steel. The nominal composition for this alloy is given in table 1.7. The microstructure of this alloy is shown by fig 1.5. This composition gives 45% ferrite and 55% austenite. Heat treatment for this alloy has been annealed at 1050ºC.

The characteristics of SAF 2205 are:

- Good Weldabilitty.
- Good resistance to SCC (stress corrosion cracking)
- High resistance to crevice, erosion, and pitting corrosion and fatigue corrosion.
- High mechanical properties.

The high mechanical strength of SAF 2205 allows for thickness reduction and therefore it helps for weight saving. SAF 2205 is a good alternative for austenitic steels in heavy load structures. The temperature of a ductile to brittle transition of this alloy is roughly - 55^{o}C; hence the impact toughness of this alloy is good. It also has a higher thermal conductivity and a lower co-efficient of thermal expansion than austenite stainless steels (22), (23). Because of high corrosion resistance of SAF 2205, this material is suitable for using in environments containing chlorides and hydrogen sulphide. It also could be used in production tubing and flow lines for the extraction of oils and gas from sour wells. SAF 2205 is also suitable for heat exchangers where chloride bearing water or brackish water is used as a cooling medium (24). Different names of this alloy in different standard systems are shown in table 1.8.

Element%	C%	Ni	Mo	N	Cr	Si	Mn	P	S
Wt.%	0,021	5,25	3,26	0,185	22,30	0.65	1,65	0,026	0,012

Table 1.7: Nominal composition of SAF2205 given in weight percentage [wt. %].

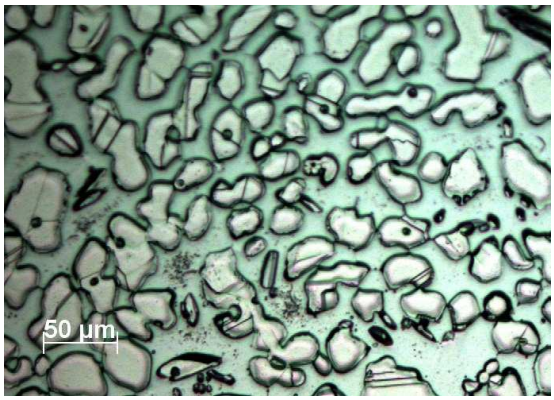


Fig 1.5 Microstructure of SAF 2205(annealed at 1050 ºC)

SANDVIK	UNS	EN	W-Nr	DIN	AFNOR	SS
SAF 2205	S31803/S32205	1.4262	1.4462	X2CrNiMoN22 5 3	Z2CND 22-05-03	2377

Table 1.8: Type of steel

1.4.5 Alloy 718

International Nickel Company developed Alloy 718 in the 1950. This alloy is used mainly for hot section turbine for the reason that Alloy 718 is a high strength super alloy which is capable for a long time service up to 650C°. In the end of the 1970s Alloy 718 are used commonly because for the cobalt crisis therefore Alloy 718 which is not alloyed with cobalt were more used and became the most important super alloy used in turbine engine.

The nominal composition of the Alloy 718 and the composition of the actual bar which is used in this study are given in table 1.9. Grain size, the average diameter of the grain and hardness of a different heat treatment of this alloy is also given in table 1.10.

Alloy 718 was heat treated into four different conditions, large and small grains, solution annealed and fully aged. Fig 1.6 is shown microstructure of Alloy 718 in different heat treatment conditions (25).

ALLOY	Ni	Cr	Co	Fe	C	Mo	Al	Ti	Nb	B	Mn	Si	Cu
NOMINAL	Bal	19	0.0	18,5	0,04	3,0	0,5	0,9	5,1	,006	0,2	0,2	…..
Actual Bar	Bal	18,36	0,33	17,49	0,04	3,15	0,56	0,92	5,46	,001	0,09	0,05	0,14

Table 1.9: Chemical compositions of actual bar (25)

Material	Grain Size [ASTM]	Average Diameter [µm]	Hardness [HV]
Large Grains Solutioned (LGS)	3	127	170
Large Grains Aged (LGA)	3	127	430
Small Grains Solutioned (SGS)	9	16	250
Small Grains Aged (SGA)	9	16	445

Table 1.10: Grain size and hardness (25)

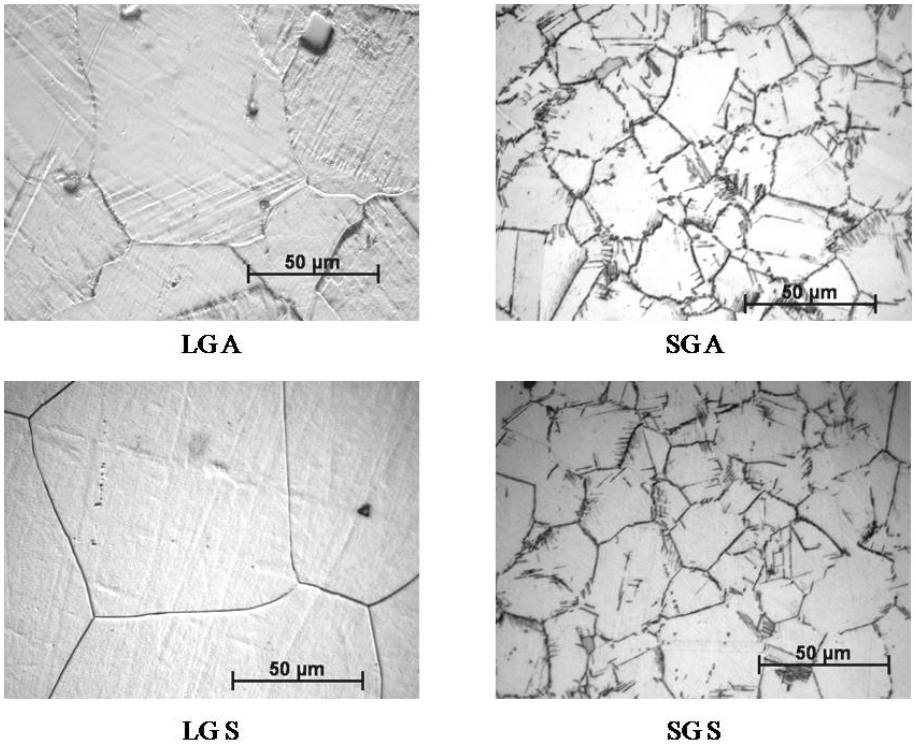


Fig1.6: Microstructure obtained by the different heat treatments for Alloy 718 (25)

2 Experimental and Analysis techniques

2.1 Sample preparation

The discs of the bars were divided to four parts for SAF 2205, SS 2348, Alloy 718 and three parts for SS 1672, SS 2303 from surface to center for analyzing the variation of the micro hardness between different position of the bar. Samples were cut by abrasive machine. Fig 2.1.a and 2.1.b are shown the schematic of cutting for our samples.

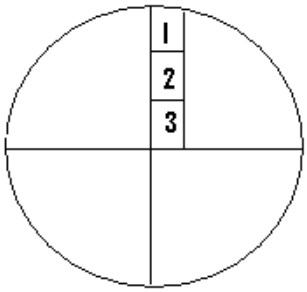


Fig 2.1a: Schematic of cutting for SS 2303, SS 1672

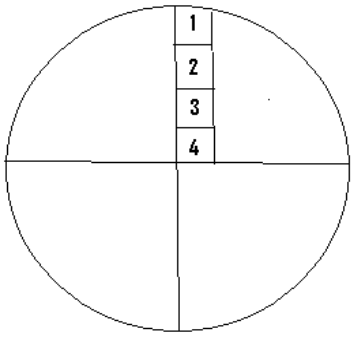


Fig 2.1.b: Schematic of cutting for SS 2348, SAF2205, Alloy 718

Then the samples were hot mounted in multifast polymer at 180C° for 3 minutes. The metallographic preparation is done by automatic grinding and polishing machines. The grinding was done in two steps. 120,240 GRIT grinding paper were used, afterward the samples were polished with 9, 3 and 1 micron diamond paste respectively and cleaned with soap water and ethanol. The maximum load applied in all these steps for micro hardness test was 30N.

For etching the samples first of all Villella etchant was tried with 45 ml glycerol 87%, 15 ml nitric acid 65% and 30 ml hydrochloric 32%. It takes more than 5 minutes to etch but the results were not good. Afterwards Kallin etchant was tried with 33 ml distilled water, 33 ml ethanol 96%, 33 ml hydrochloric acid 32% and 1.5 g Copper(II) chloride. This etchant did not work for SS 2348 and SAF 2205.

Finally the nital 3% was choosen for SS1672 with 3% Nitric acid 65% and 100ml ethanol 96% as etchant. For SAF 2205,SS2348 and SS 2303 was choosen 10 percent, oxalic acid +H2O and applied by electo etching machine with 15 V in ,23 C° for 1 minute.

2.2 Micro hardness measurements

Micro hardness was measured by SHIMADZU HMV-2000 with 5,15,25,50 and 100 N load for understanding which load is suitable for our test. Samples were selected from 2nd position from the surface as it is shown in fig 2.1.

2.3 Measurement of micro hardness by automatic machine

Final measurements were performed after the suitable load for the automatic machine was selected. One new series of samples have been mounted and polished like previous samples again but they were not etched. Because for measurements by the automatic micro hardness machine samples should be polished but it is better that they are not etched. Samples have been collected from surface and center of the plate. Measurement of the micro hardness test was carried out by Buehler micromet 2104. 100 measurements were done on each sample. 100 N was used for the load of micro hardness machine. The distances between indents were 0.15 mm and distance between lines were 0.15 mm. lastly total traverse were 1.35 mm. fig 2.2 is shown the indentations after measurement of micro hardness.

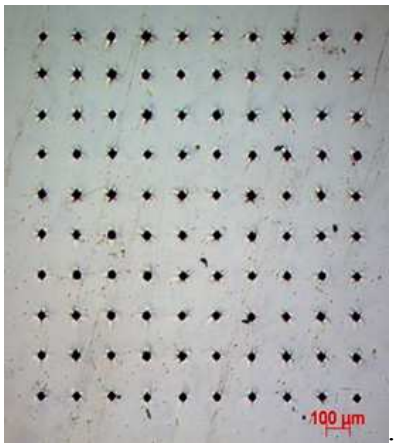


Fig 2.2 Indentations after measurement of micro hardness

2.4 Macro Hardness measurement

Wolpert Dia Testor hardness tester was used for measuring tests. The hardness test was performed by using a 10 kg load determined by Vickers hardness number.Vickers number could be determined by dividing the applied load in kg force by the projected area of indentation in square millimetres.

2.5 Evaluation of machinability connected to abrasive wear

Following formula indicating the potentiality of machinability for abrasive wear was collected from Skärande Bearbetning-teori och modeler book (26). In this section relationship between hardness and machinability and how this formula is reliable for our material will be evaluated. Mean flank and mean notch for Alloy 718 were collected from Stefan Olovsjö project (25). Finally results would be compared to mean flank and mean notch.

(3)

W_{ab}= potentially of abrasive wear

$H_{HRC,makro}$ = macro hardness

ω_{frac}= constant which is related to fraction of carbides

ω_{form}= constant which is related to shape of carbide

$H_{HRC.max}^{Hmikro}$= maximum of micro hardness in measurements

$H_{HRC,min}^{mikro}$= minimum of micro hardness in measurements

3 Results

All of the data that were measured in addition the statistical analysis are in the appendix from table 8.1 till 8.39. Normal distribution and histogram diagrams are drawn by SAS jmp.

3.1 Alloy 718 Large Grains Solution

In table 3.1, average macro hardness measurements for 10kg load obtained from different positions on the samples are shown. Also, the average micro hardness values for 100 measurements with 100g load are indicated. Figures 3.1 shows normal distribution and histogram diagrams for surface and center of the bar. All the micro hardness measurement results for LGS are listed in table 8.43 for surface and 8.44 for centre of the bar in appendix. Standard deviation for micro hardness measurement results is shown in table 3.1 and also the carbide volume fraction. For this alloy ω_{frac} is extracted from fig 3.2 finally W_{ab} is calculated and shown in table 3.1.

Location	Macro hardness [Hv10kg]	Micro hardness [Hv100g]	Micro hardness Stdev	ω_{frac}	W_{ab}
Surface	170	201	19	0.39	205
Centre	170	207	9,8	0.39	191

Table 3.1: Results for Large grain solution,

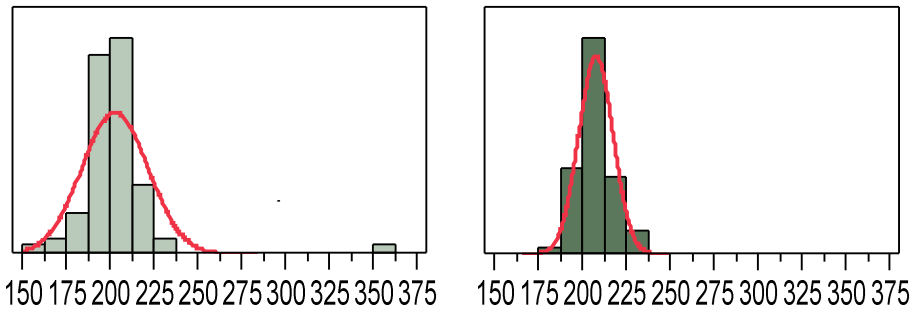


Fig 3.1: Normal distribution and histogram diagram of micro hardness results for LGS (surface)

In figure 3.2 fraction of the different phases at 1050 C° are shown. These were simulated using JMat Pro 5.0v software.

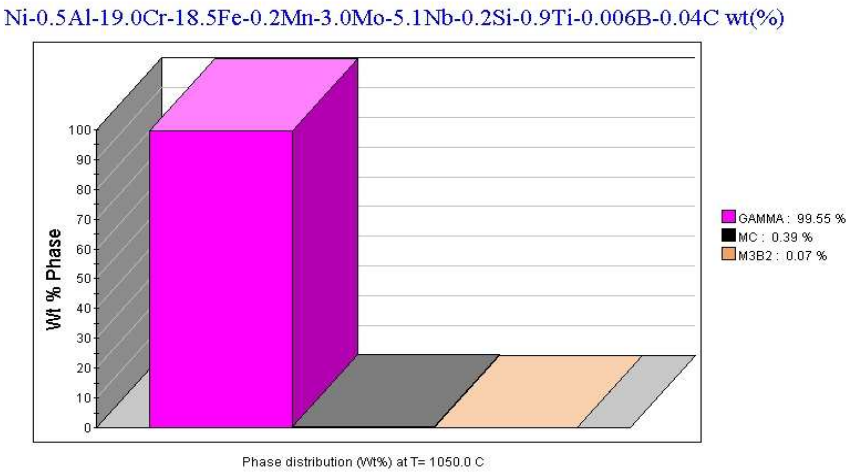


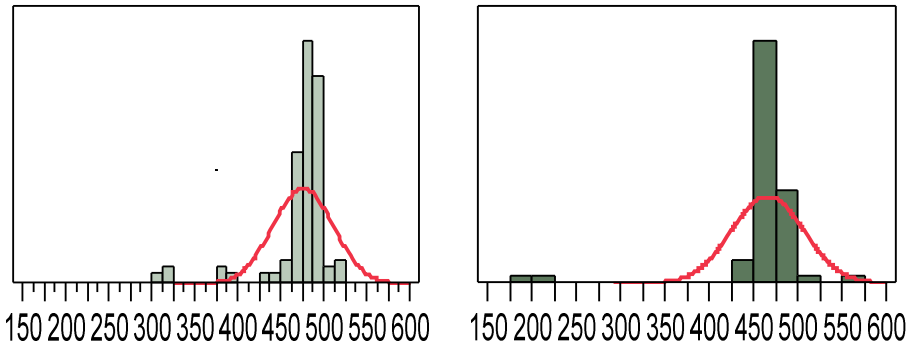
Fig 3.2 Fraction of different phases for Alloy 718 large grain solution heat treated, at 1050°C

3.2 Alloy 718 Small Grain Aged

Average of macro hardness with 10kg load from different position of the samples and average of micro hardness for 100 measurements with 100g load are shown in Table 3.2. In Figures 3.3 normal distribution and histogram diagrams are shown for surface and center of the bar. All results related to the micro hardness measurement for SGA are listed in table 8.45 for surface and 8.46 for centre of the bar in appendix. Standard deviation for micro hardness measurement results is also in table 3.2 and the fraction of the carbide. For this alloy ω_{frac} is extracted from fig 3.4 finally W_{ab} is calculated and shown in table 3.2.

Location	Macro hardness [Hv10kg]	Micro hardness [Hv100g]	Micro hardness Stdev	ω_{frac}	W_{ab}
Surface	445	475	35	0.60	573
Centre	445	471	41	0.60	526

Table 3.2: Results for small Grain Aged



Surface *Center*

Fig 3.3: Normal distribution and histogram diagram of micro hardness results for SGA

Figure 3.4 are shown the fraction of different phases for small grains aged at 718 C° alloy 718 which is the heat treatment temperature for precipitation hardening for this alloy.

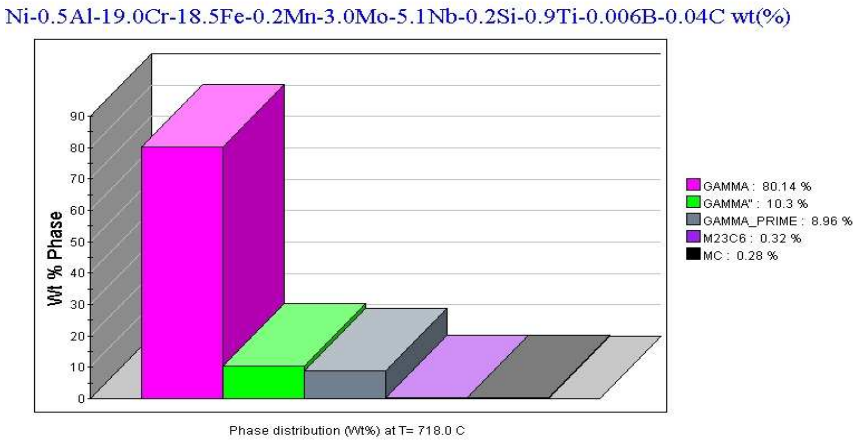


Fig 3.4 Fraction of different phases for Alloy 718 small grain aged at 718°C

3.3 Alloy 718 Large Grains Aged

In table 3.3 is shown average of macro hardness, micro hardness, standard deviation for micro hardness results, fraction of carbides and W_{ab} for LGA with procedure like LGS. Figures 3.5 shows normal distribution and histogram diagrams for surface and center of the bar. All the results related to the micro hardness measurement for LGA are listed in table 8.47 for surface and 8.48 for centre of the bar in appendix. For this alloy ω_{frac} is extracted from fig 3.6

Location	Macro hardness [Hv10kg]	Micro hardness [Hv100g]	Micro hardness Stdev	ω_{frac}	W_{ab}
Surface	430	477	16	0.60	470
Centre	430	491	34	0.60	496

Table 3.3: Results for Large grain aged

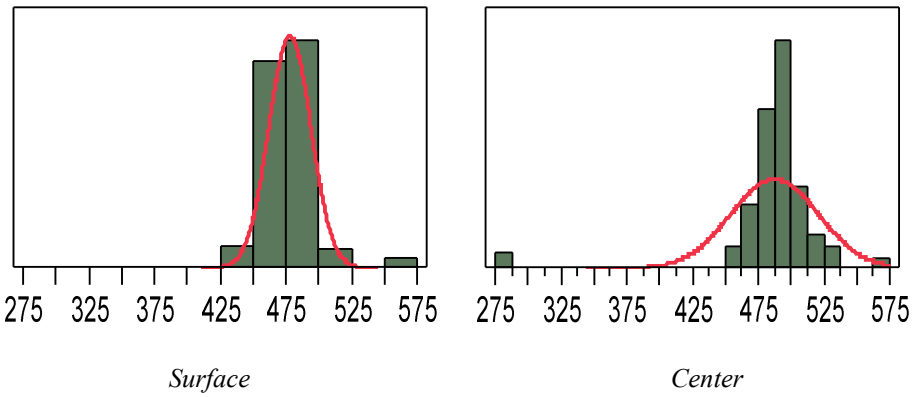


Fig 3.5: Normal distribution and histogram diagram of micro hardness results for LGA

In fig 3.6 the fraction of the different phases at 718 C° are shown. This fig is simulated by the Jmat Pro 5.0 software.

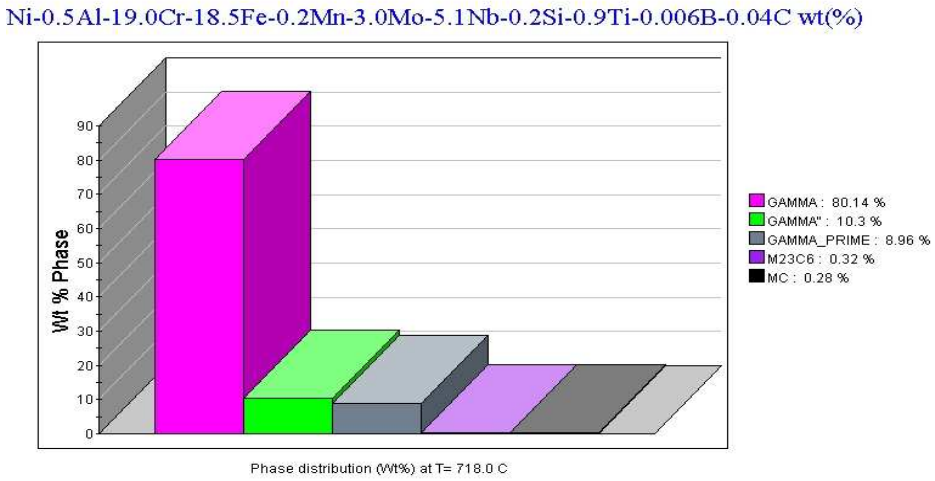


Fig 3.6 Fraction of different phases for Alloy 718 large grain aged at 718°C

3.4 Alloy 718 Small Grain Solution

Average of macro hardness, micro hardness, standard deviation, fraction of carbides and W_{ab} for SGS with same process as LGS are shown in table 3.4. Figures 3.7 shows normal distribution and histogram diagrams for surface and center of the bar. All the results related to the micro hardness measurement for SGS are listed in table 8.49 for surface and 8.50 for centre of the bar in appendix. For this alloy ω_{frac} is extracted from fig 3.8

Location	Macro hardness [Hv10kg]	Micro hardness [Hv100g]	Micro hardness Stdev	ω_{frac}	W_{ab}
Surface	250	243	16,7	0.39	290
Centre	250	279	11.4	0.39	273

Table 3.4: Results for Small grain solution.

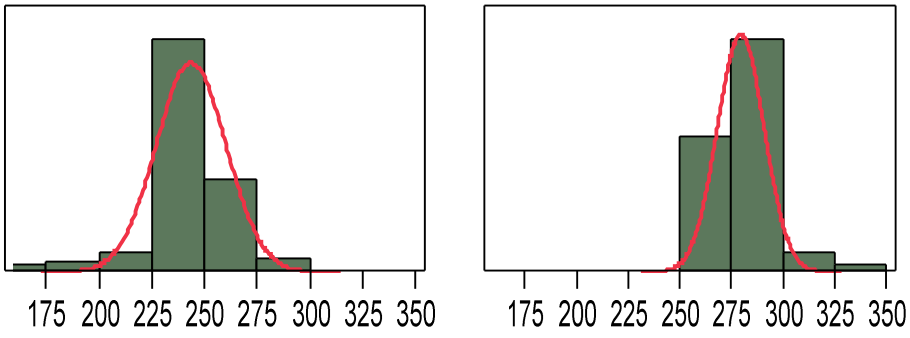


Fig 3.7: Normal distribution and histogram diagram of micro hardness results for SGS (surface)

In fig 3.8 the fraction of the different phases at 1050 C° are shown. This fig is also simulated by the JMatPro 5.0 software.

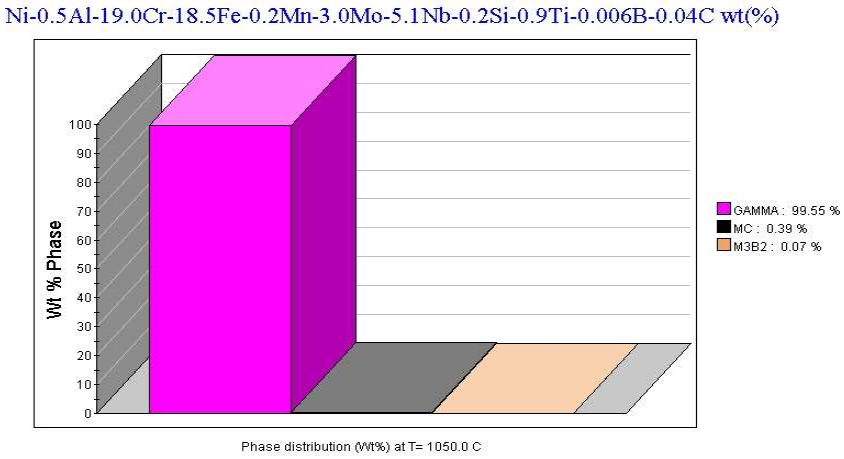


Fig 3.8 Fraction of different phases for Alloy 718 small grain solution heat treated at 1050°C

3.5 Machining experiments

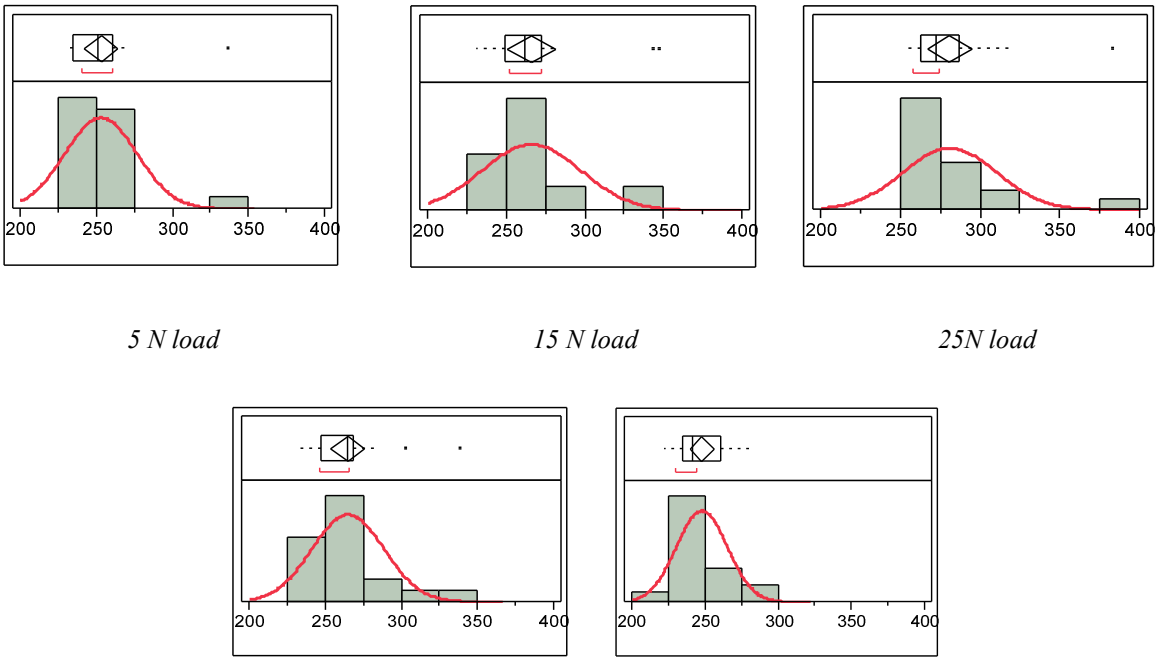
Table 3.5 shows different machinability values for different heat treatment of Alloy 718. Mean flank and notch were calculated before by Stefan Olovsjö for the same samples were used in this thesis (25). For calculating W_{ab} for below alloys the ω_{frac} and ω_{form} were considered one

					W_{ab}	
Alloy	Wab Mean	Mean Flank [µm]	Mean notch [µm]	Wab Variance	Surface	Center
LGS	198	202	132	98	205	191
SGA	549.5	269	124	1104,5	573	526
LGA	483	280	155	338	470	496
SGS	281,5	174	78	144,5	290	273

Table 3.5: different results related to the machinability of the Alloy 718 for the different heat treatment

3.6 SAF 2205

Normal distribution of the micro hardness results are shown in Fig 3.9. The following samples were selected from 2nd position from the surface as it is shown in figures 2.1 and 2.2. Micro hardness was measured ten times with 5,15,25,50 and 100 N loads for understanding which load suitable for our test. All of the data that were measured in addition the statistical analysis are presented in the appendix from table 8.1 till 8.39.



5 N load *15 N load* *25N load*

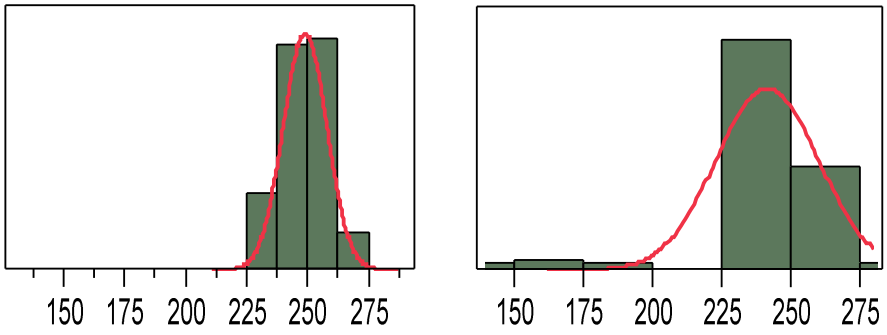
50 N load *100 N load*

Fig 3.9: Normal distribution diagrams of the micro hardness results for SAF2205 with different load

Table 3.6 shows average of macro hardness for 10kg load from different position of the samples. Average of micro hardness for 100 measurements with 100g load is also shown in this table. Figures 3.10 shows normal distribution and histogram diagrams for surface and center of the bar. All the micro hardness measurement results for SAF 2205 are listed in table 8.57 for surface and 8.58 for center of the bar in appendix. Standard deviation for micro hardness measurement results is in table 3.6 as well. Fraction of carbide were considered one for SAF 2205 because the simulation diagrams shows fraction of carbide in 1050ºC zero finally W_{ab} is calculated and shown in table 3.6.

Location	Macro hardness [Hv10kg]	Micro hardness [Hv100g]	Micro hardness Stdev	W_{ab}
Surface	236	249	8.95	279
Centre	236	241	18.6	369

Table 3.6: Results for SAF 2205

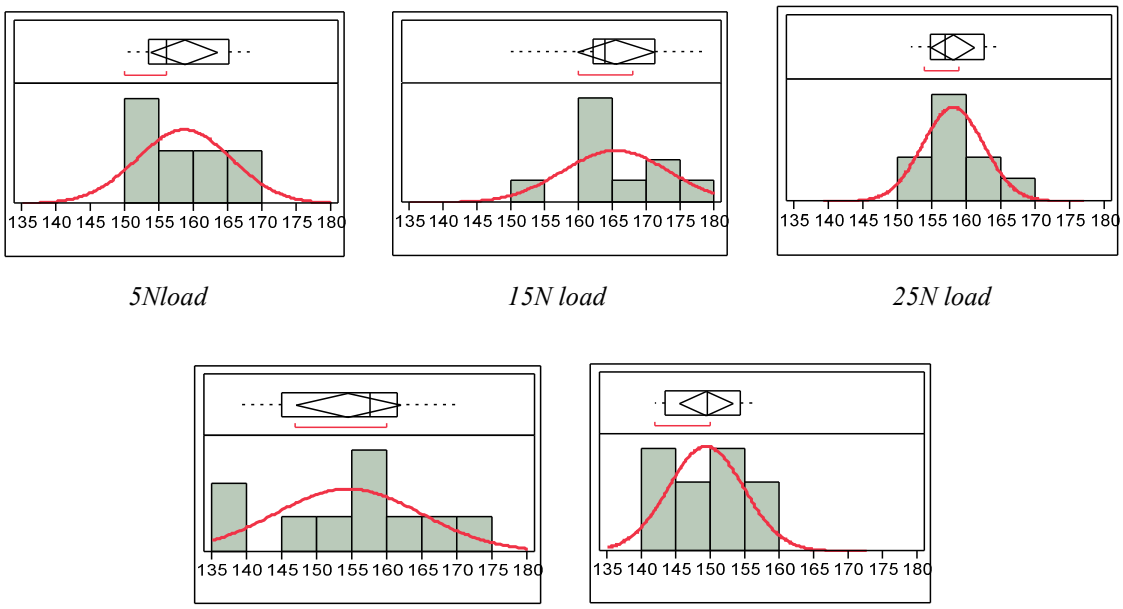


Surface *Center*

Fig 3.10: Normal distribution and histogram diagram of micro hardness results for SAF 2205

3.7 SS 2348

Fig 3.11 shows normal distribution diagrams for ten times micro hardness measurement with different load for SS 2348. It was done like SAF 2205 with same procedure.



5Nload *15N load* *25N load*

50N load *100N Load*

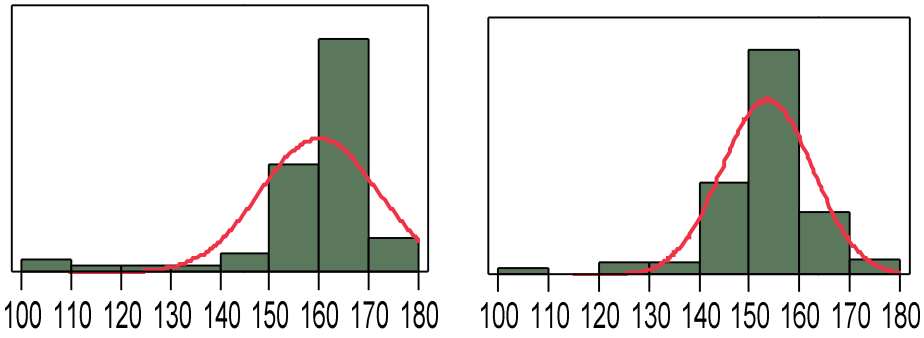
Fig 3.11: Normal distribution diagrams of the micro hardness results for SS 2348 with different load

In table 3.7 is shown average of macro hardness from different position of the samples with 10kg load. Average of micro hardness for 100 measurements with 100g load is also shown in this table. All the micro hardness measurement results for SAF 2205 are listed in table 8.55 for surface and 8.56 for center of the bar in appendix. Figures 3.12 shows normal distribution and histogram diagrams for surface and center of the bar. Standard deviation for micro hardness measurement results is also in table 3.6. Fraction of carbide were considered one for

SS 2348 because the simulation diagrams shows fraction of carbide in 1050ºC zero finally is calculated and shown in table 3.7.

Location	Macro hardness [Hv10kg]	Micro hardness [Hv100g]	Micro hardness Stdev	
Surface	152	160	11.8	226
Centre	138	154	9.1	188

Table 3.7: Results for SS2348

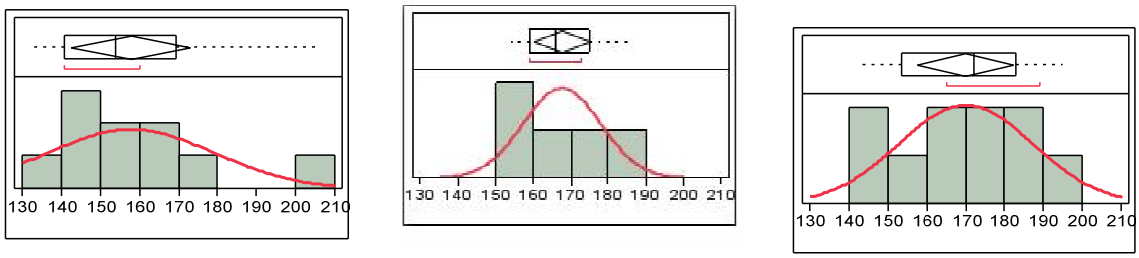


Surface *Center*

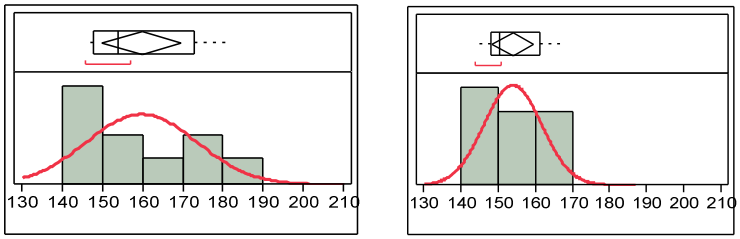
Fig 3.12: Normal distribution and histogram diagram of micro hardness results for SS 2348

3.8 SS2303

Fig 3.13 shows normal distribution diagrams of micro hardness results for SS 2303. 10 times measurement was done for each load like SAF2205 and SS 2348.



5 N load *15 N load* *25 N load*



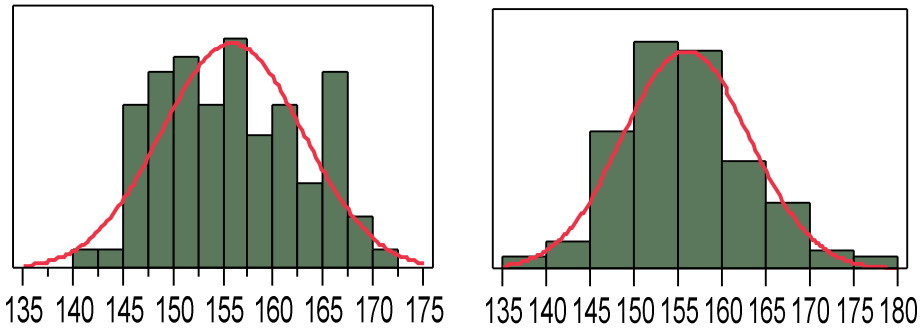
50 N load *100 N load*

Fig 3.13: Normal distribution diagrams of the micro hardness results for SS 2303 with different load

From different position of the samples with 10kg load, macro hardness was measured and the average of them is shown in table 3.8. Average of micro hardness for 100 measurements with 100g load is also shown in this table 3.8. All the micro hardness measurement results for SS 2303 are listed in table 8.51 for surface and 8.52 for center of the bar in appendix. Figure 3.14 shows normal distribution and histogram diagrams. Standard deviation for micro hardness measurement results is also in table 3.8. Fraction of carbide were considered one for SS 2303 because the simulation diagrams shows fraction of carbide in 1050 *ºC* zero finally W_{ab} is calculated and shown in table 3.8.

Location	Macro hardness [Hv10kg]	Micro hardness [Hv100g]	Micro hardness Stdev	W_{ab}
Surface	134	156	7,07	186
Centre	130	159	7.23	171

Table 3.8: Results for SS2303

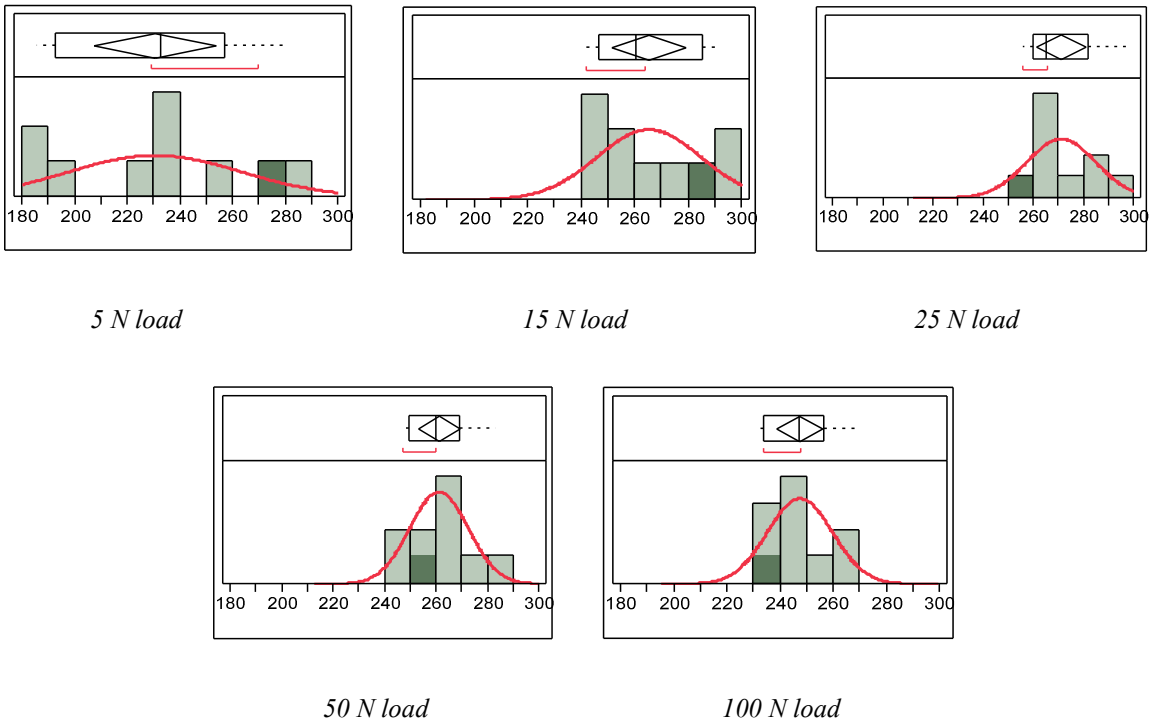


Surface *Center*

Fig 3.14: Normal distribution and histogram diagram of micro hardness results for SS2303

3.9 SS 1672

Following fig is normal distribution diagrams for micro hardness measurements results with different load for SS1672. All of the process for measuring the micro hardness is like SAF2205, SS2348 and SS 2303.



5 N load *15 N load* *25 N load*

50 N load *100 N load*

Fig 3.15: Normal distribution diagrams of the micro hardness results for SS 2303 with different load

Table 3.9 is shown average of macro hardness with 10 kg load from different position of the samples it also shown the average of micro hardness for 100 measurements with 100g load and all of the micro hardness measurement results for SS 1672 is listed in table 8.53 for surface and 8.54 for center of the bar. W_{ab} is also calculated and shown in table 3.9. For calculating W_{ab} fraction of carbide were considered one. Figures 3.16 shows normal distribution and histogram diagrams.

Location	Macro hardness [Hv10kg]	Micro hardness [Hv100g]	Micro hardness Stdev	W_{ab}
Surface	235	242	7,23	267
Centre	238	241	15.7	300

Table 3.9: Results for SS1672

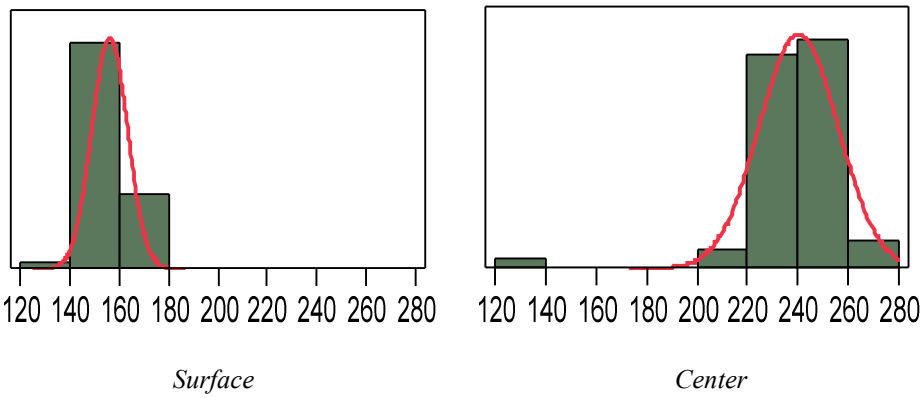


Fig 3.16: Normal distribution and histogram diagram of micro hardness results for SS1672

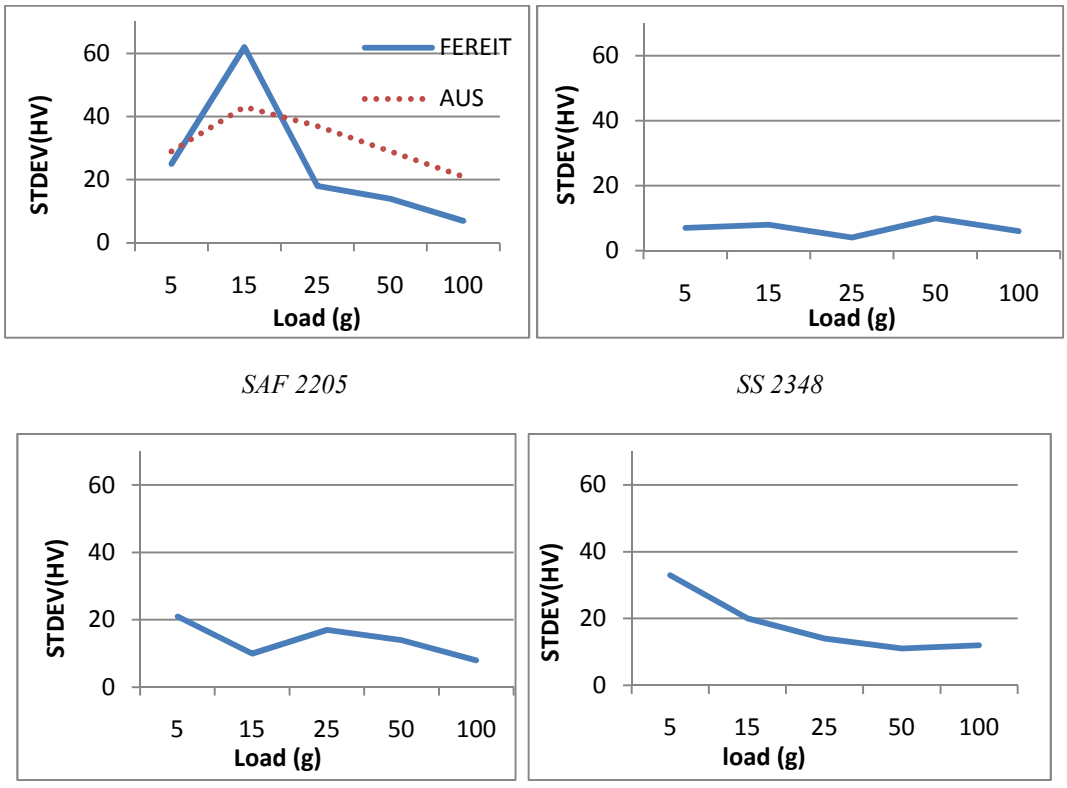
4. Discussion

4.1 Which load could be used for micro hardness test

Micro hardness was measured with 5,15,25,50 and 100N load for understanding which load is suitable for our test. For 5N the variation of micro hardness was high because 5N load generated small indentations since the error for measuring the actual end of the indentation is greater. In addition 15N is a low load and the small amount of elastic recovery is considerable. For 25N load area of the indentation is still smaller than the grain size it means that we can use higher load. In 50N load distribution of micro hardness is better than previous loads. 100N loads could be chosen between 5, 15, 25 and 50g for measuring micro hardness of these alloys because it has less error and better normal distribution diagram also the indentation of the hardness is not larger than the grain sizes of this material.

4.1.2 Standard deviation of micro hardness results for different materials and loads

As it is indicated in fig 4.1, four different micro hardness results were compared for different load and material, it could be obtained that totally the standard deviation for 100g load is less than 5, 15, 25, 50 gram load and it means that it has less error. Therefore 100g load was chosen for automatic micro hardness test.



SAF 2205 *SS 2348*

SS2303 *SS1672*

Fig 4.1 Standard deviation of micro hardness for different load and material

It could be seen from these standard deviation diagrams that the standard deviation of the SS2348 and SS2303 are almost constant by different applied load. These materials are single phase material, austenite and ferrite respectively. The standard deviation would therefore be low because independent of the load the measurements are conducted in on phase. Standard deviation of SS 1672 is almost constant in a range of 25-100 g load, the material is a ferritic prelatic carbon steel. The standard deviation is decreased when the load increases because the hardness measured, is the "bulk" hardness of the material. Small loads give a smaller indent and the hardness would then be more correlated with one phase of the material. SAF 2205 is a duplex stainless steel; the standard deviation is measured for the two different phases. The standard deviation for both phases increases at 15grams and the decrees with increasing load. The material is in a strain hardened condition (see 4.3); the standard deviation will decrease with increasing load because the hardness measurement will be less surface dependent.

4.2 Differences of micro hardness between surface and center of the bar:

The micro hardness was measured from the surface and center zone for the SS2348 and SS2303 with 15N and 25N loads. As it is indicated below the average micro hardness for the center is lower than the surface.

4.2.1: SS2348

Table 4.1 is shown average of micro hardness with 15 and 25 N load from surface and center of the SS 2348 bar. All of the detail results are in table 8.42 and 8.43. According to Table 4.1 average hardness of surface for this alloy is higher than surface of the bar. Fig 4.2 shows microstructure of SS2348 from surface and center of the bar, as it is seen grain sizes of the surface are smaller than center of the bar, probably due to the different cooling rates between surface and center, this can be explained the differences between hardness of the surface and center of the bar. Fig 4.3 shows one way analysis of surface and center of the bar for 25N load. Fig 4.4 show normal distribution diagram for micro hardness results with 25 N load for surface and center of the bar.

ZONE	Average of micro hardness for 15 N load	Average of micro hardness for 25 N load
Surface	167.4	173.9
Center	149.7	153.5

Table 4.1 differences between average of micro hardness in a different position and load for SS2348

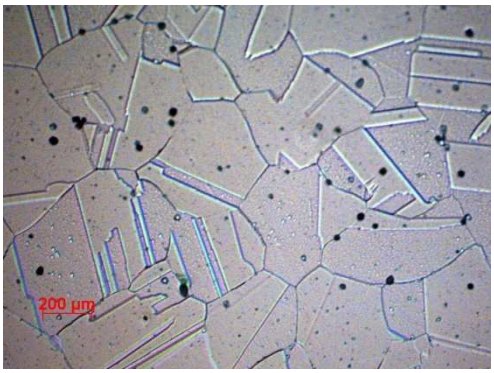


Fig 4.2a Microstructure of SS 2348 from Surface

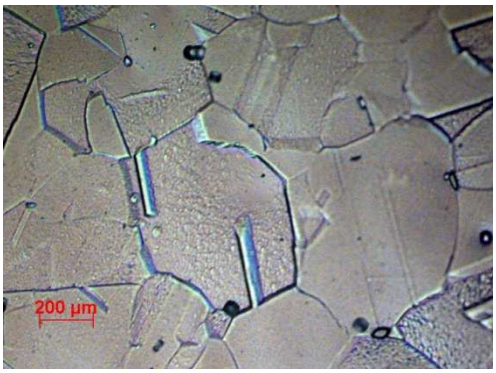


Fig 4.2b Microstructure of SS 2348 from Center

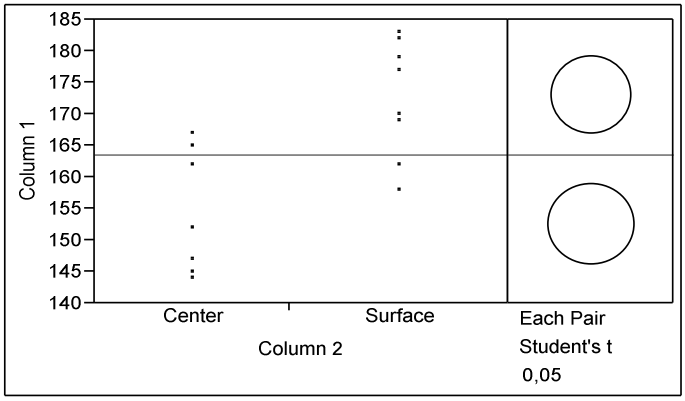
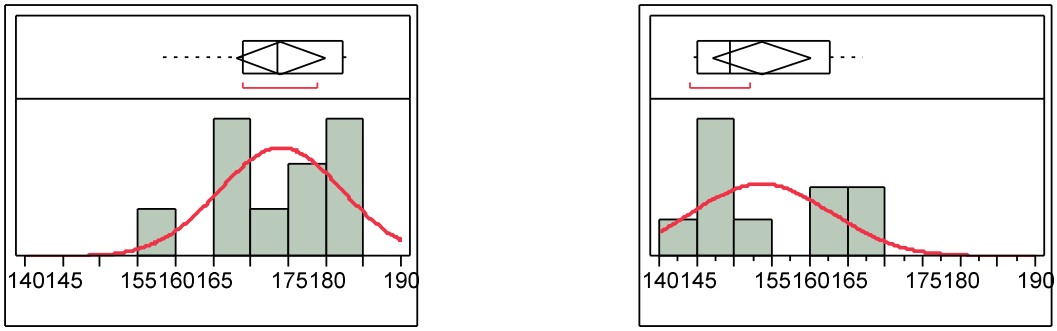


Fig 4.3: One way Analysis of surface and center for 25N load of SS2348



Surface *Center*

Fig 4.4: Normal distribution diagram of micro hardness from the Surface and center for 25 N load of SS2348

4.2.2: SS2303

Table 4.2 shows average of micro hardness with 15N and 25N load from surface and center of the SS 2303 bar. All of the detail results are in table 8.40 and 8.41. Fig 4.5 shows one way analysis of surface and center of the bar for 25N load. As it is obvious from this fig average hardness of the surface is higher than the center of it. It can be explained for differences of

cooling rate between surface and center of the bar which leads to differences between grain sizes of the surface and center (see 4.2.1). Fig 4.6 shows normal distribution diagram for micro hardness results with 25N load for surface and center of the bar.

ZONE	Average of micro hardness for 15 N load	Average of micro hardness for 25 N load
Surface	188.6	192
Center	172.6	172.7

Table 4.2 differences between average of micro hardness in a different position and load for SS2303

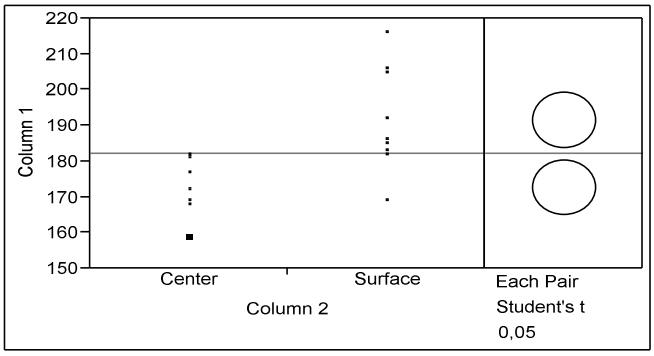
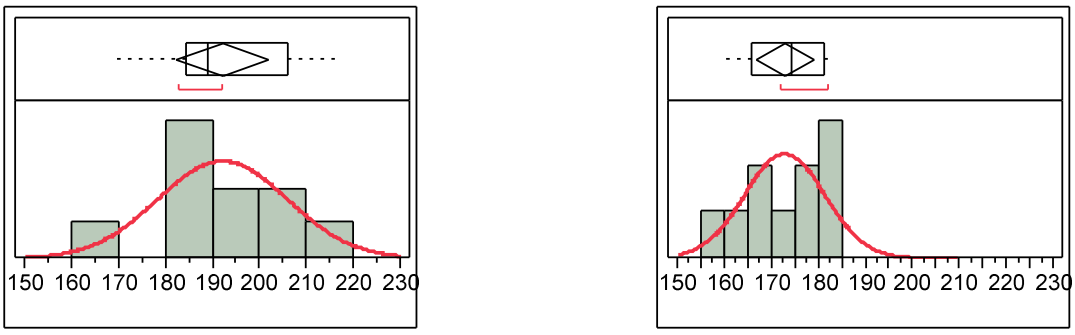


Fig 4.5 One way Analysis of surface and center for 25N load of SS2303



Surface *Center*

Fig 4.6 Normal distribution diagram of micro hardness from the Surface and center for 25 N load of SS2303

4.3 Differences of micro hardness between different phases for SAF2205

Ten times micro hardness were measured for each phase (Austenite & Ferrite) of SAF 2205 with different load. Statistical result of micro hardness measurements are listed in table 4.3

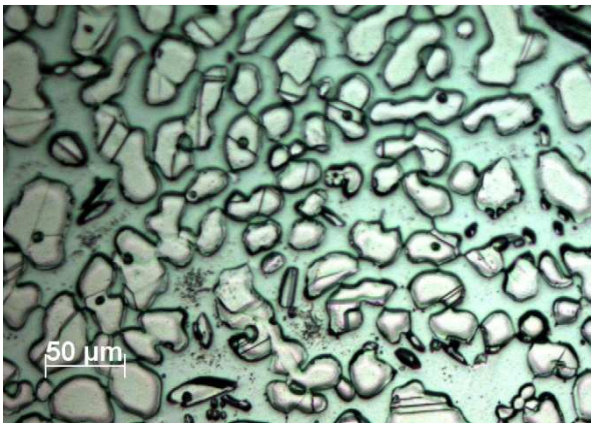


Fig 4.7: Microstructure of SAF 2205(annealed at 1050 ºC)

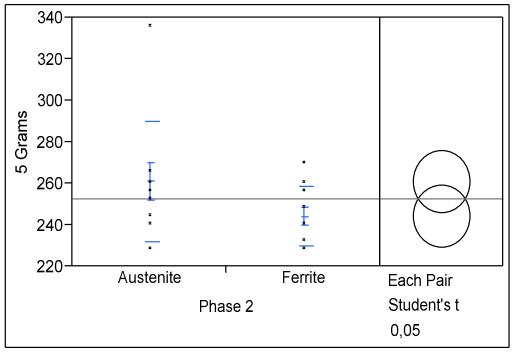
Fig 4.7 shows microstructure of SAF 2205. In this fig continues phase is considered ferrite and not continues phase is Austenite, the phases have been verified with EDX, and the results are in the appendix.

Level	Load	Number	Mean HV	Std Dev	Std Err Mean	Lower 95%	Upper 95%
Austenite	5	10	261,100	28,7729	9,0988	240,52	281,68
Ferrite	5	10	244,300	14,4072	4,5559	233,99	254,61
Austenite	15	10	268,600	42,5420	13,453	238,17	299,03
Ferrite	15	10	243,200	61,6258	19,488	199,12	287,28
Austenite	25	10	287,600	37,2863	11,791	260,93	314,27
Ferrite	25	10	273,300	18,0742	5,716	260,37	286,23
Austenite	50	10	271,600	29,4664	9,3181	250,52	292,68
Ferrite	50	10	257,500	14,4626	4,5735	247,15	267,85
Austenite	100	10	255,400	21,2875	6,7317	240,17	270,63
Ferrite	100	10	239,700	7,1655	2,2659	234,57	244,83

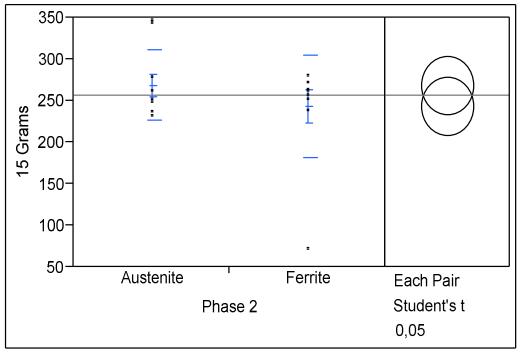
Table 4.3: Means and standard deviation results for Austenite and ferrite of SAF 2205

Fig 4.8 shows one way analysis for different load and phases of SAF 2205, as it is indicated ferrite and austenite phases of SAF 2205 have different hardness. Since for machining of SAF 2205 variation of hardness between phases should be considered.

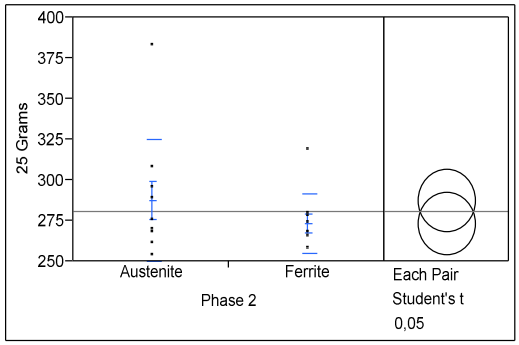
Fig 4.8 indicates that by increasing load, differences between hardness of Austenite and ferrite for this alloy is more sensible.



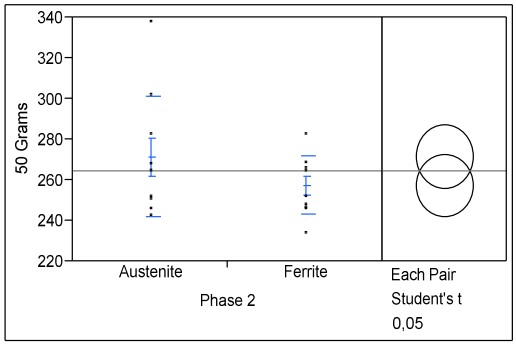
5N load



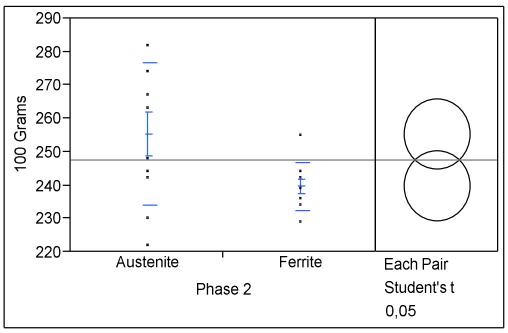
15N load



25N load



50N load



100 N load

Fig 4.8: One way Analysis for micro hardness results of austenite and ferrite with different load of SAF2205

Fig 4.9 shows mean micro hardness for ten measurements for each phase versus different applied load in micro hardness measurements. As it could be seen from fig 4.9, average of hardness for austenite is more than ferrite but the simulation program (JMatPro 5.0v software) tells us hardness for austenite is 215 VPN and for ferrite is 261 VPN in a non strain hardening condition. Nyström et al. showed that the strain hardening effects lead to 50% increase in hardness of austenite, while this increase for ferrite is around 15%. (26). It seems strain hardening is reason for these differences.

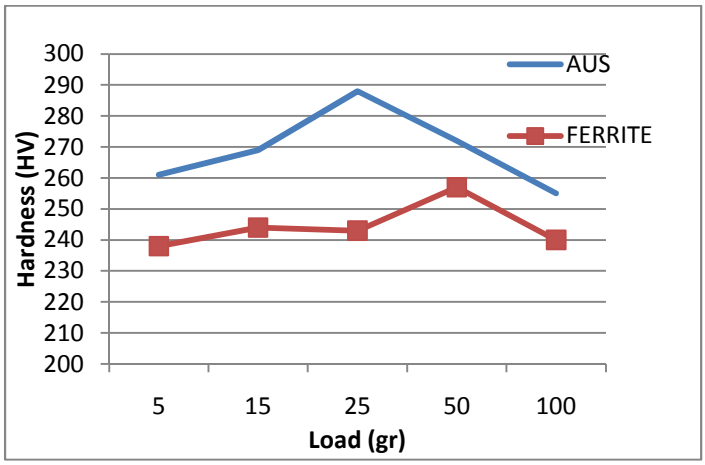


Fig 4.9: Hardness vs. different applied load in micro hardness measurements for SAF 2205

5 .Conclusions

- No correlation between Wab (potentially of abrasive wear) and notch wear.
- Higher Wab values give a large flank wear.
- Average of micro hardness in the surface of bar is larger than the center of bar.
- Determine the optimum load to use in the micro hardness measurement for multiphase's materials.
- SAF 2205 is significantly sensible to load variation in micro hardness testing.
- Average of hardness values in SAF 2205 for austenite phase is higher than ferrite phase it seems strain hardening is reason for this.

6. Acknowledgements

This is a 30-credit thesis within Materials abrasives wear and correlation with potential machinability**.** It is done from 2010.01.11 to 2010.10.01.

I hereby would like to thank all people who somehow helped me to achieve this result. First, I would like to thank Professor Lars Nyborg my Examiner and Stefan Olovsjö my supervisor for their helps and accessibility during this project and the whole education period. I would like to thank Kenneth Hamberg for his help with etching the samples.

In the end, I would like to thank my parents and friends who supported me during the whole Education and this thesis.

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Appendixes:

SS 2303:

SS2303 (A2)	D1	D2	HV	LOAD	PHASE
1	7,5	7,4	167	5	Ferrite
2	6,7	6,7	206	5	Ferrite
3	7,1	7,4	176	5	Ferrite
4	7,8	8,1	146	5	Ferrite
5	8,1	8,1	141	5	Ferrite
6	7,7	7,8	154	5	Ferrite
7	8,3	8,4	132	5	Ferrite
8	7,8	7,4	160	5	Ferrite
9	7,8	7,7	154	5	Ferrite
10	8,2	8	141	5	Ferrite

Table 8.1: Micro hardness results with 5 N load for SS2303

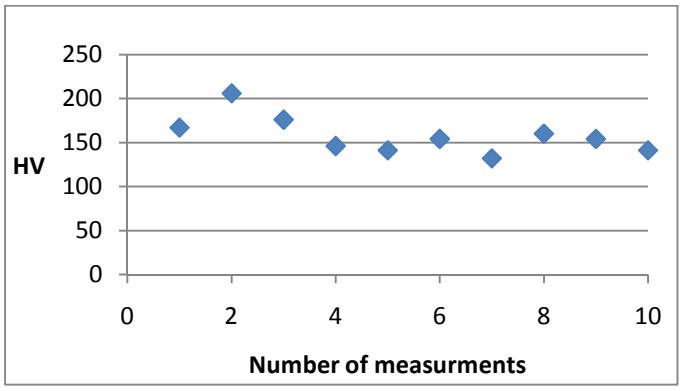


Fig 8.1: Micro hardness diagram for table 8.1

Quantiles:		
100,0%	maximum	169
99,5%		169
97,5%		169
90,0%		169
75,0%	quartile	165,25
50,0%	median	156
25,0%	quartile	153,5
10,0%		150,2
2,5%		150

Moments:	
Mean	158,6
Std Dev	6,9153613
Std Err Mean	2,1868293
Upper 95% Mean	163,54695
Lower 95% Mean	153,65305
N	10

Fitted Normal
Parameter Estimates

Type	Parameter	Estimate	Lower 95%	Upper 95%
Location	μ	157,7	142,35341	173,04659
Dispersion	σ	21,45305	14,756163	39,164906

Tables 8.2: statistical data for table 8.1

SS2303 (A2)	D1	D2	HV	LOAD	PHASE
1	12,7	12,6	173	15	Ferrite
2	13	13,4	159	15	Ferrite
3	12,6	12,7	173	15	Ferrite
4	12,8	13,6	159	15	Ferrite
5	13,4	13	159	15	Ferrite
6	12,6	13	169	15	Ferrite
7	13,2	12,9	163	15	Ferrite
8	13,3	13,5	154	15	Ferrite
9	12,3	12,5	180	15	Ferrite
10	12,3	12,2	185	15	Ferrite

Table 8.3: Micro hardness results with 15 N load for SS2303

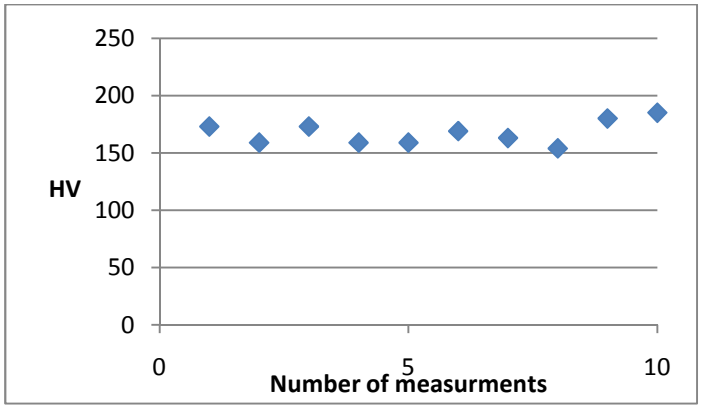


Fig 8.2: Micro hardness diagram for table 8.3

Quantiles		
100,0%	maximum	185
99,5%		185
97,5%		185
90,0%		184,5
75,0%	quartile	174,75
50,0%	median	166
25,0%	quartile	159
10,0%		154,5
2,5%		154
0,5%		154
0,0%	minimum	154

Moments	
Mean	167,4
Std Dev	10,243697
Std Err Mean	3,2393415
Upper 95% Mean	174,7279
Lower 95% Mean	160,0721
N	10

Fitted Normal
Parameter Estimates

Type	Parameter	Estimate	Lower 95%	Upper 95%
Location	μ	167,4	160,0721	174,7279
Dispersion	σ	10,243697	7,0459756	18,700998

Tables 8.4: statistical data for table 8.3

SS2303 (A2)	D1	D2	HV	LOAD	PHASE
1	15,9	16,6	175	25	Ferrite
2	17,5	17,7	149	25	Ferrite
3	15	15,8	195	25	Ferrite
4	15,9	16,1	181	25	Ferrite
5	16,3	15,8	179	25	Ferrite
6	16,8	16,7	165	25	Ferrite
7	17,4	17,1	155	25	Ferrite
8	15,8	15,5	189	25	Ferrite
9	16,2	16,9	169	25	Ferrite
10	17,9	18,2	142	25	Ferrite

Table 8.5: Micro hardness results with 25 N load for SS2303

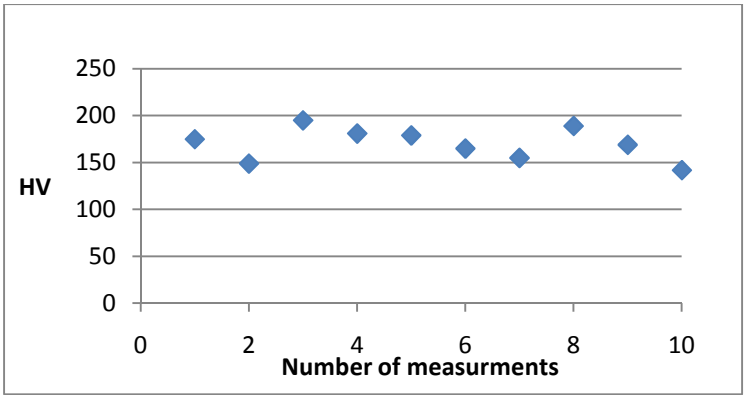


Fig 8.3: Micro hardness diagram for table 8.5

Quantiles		
100,0%	maximum	195
99,5%		195
97,5%		195
90,0%		194,4
75,0%	quartile	183
50,0%	median	172
25,0%	quartile	153,5
10,0%		142,7
2,5%		142
0,5%		142
0,0%	minimum	142

Moments	
Mean	169,9
Std Dev	17,284868
Std Err Mean	5,4659552
Upper 95% Mean	182,26485
Lower 95% Mean	157,53515
N	10

Fitted Normal
Parameter Estimates

Type	Parameter	Estimate	Lower 95%	Upper 95%
Location	μ	169,9	157,53515	182,26485
Dispersion	σ	17,284868	11,889141	31,555431

Tables 8.6: statistical data for table 8.5

SS2303 (A2)	D1	D2	HV	LOAD	PHASE
1	23,4	22,2	178	50	Ferrite
2	23,9	23	168	50	Ferrite
3	25,1	25,1	147	50	Ferrite
4	24,4	24,2	157	50	Ferrite
5	24,4	25,1	151	50	Ferrite
6	25,3	24,7	148	50	Ferrite
7	25,1	25,3	146	50	Ferrite
8	22,7	23,8	171	50	Ferrite
9	24,4	25,4	149	50	Ferrite
10	22,2	23	181	50	Ferrite

Table 8.7: Micro hardness results with 50 N load for SS2303

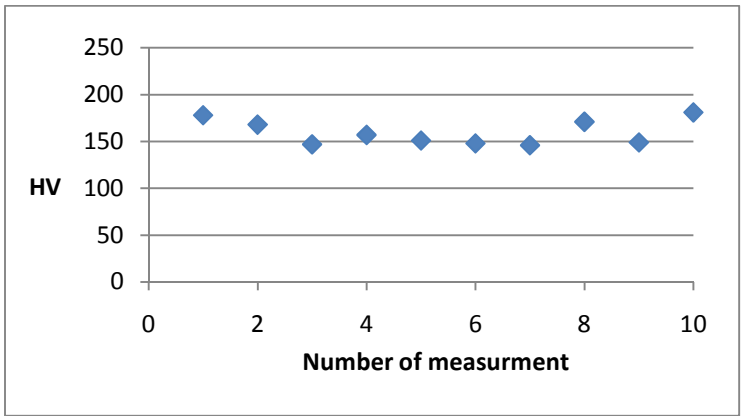


Fig 8.4: Micro hardness diagram for table 8.7

Quantiles		
100,0%	maximum	181
99,5%		181
97,5%		181
90,0%		180,7
75,0%	quartile	172,75
50,0%	median	154
25,0%	quartile	147,75
10,0%		146,1
2,5%		146
0,5%		146
0,0%	minimum	146

Moments	
Mean	159,6
Std Dev	13,615351
Std Err Mean	4,305552
Upper 95% Mean	169,33984
Lower 95% Mean	149,86016
N	10

Fitted Normal
Parameter Estimates

Type	Parameter	Estimate	Lower 95%	Upper 95%
Location	μ	159,6	149,86016	169,33984
Dispersion	σ	13,615351	9,3651176	24,856323

Tables 8.8: statistical data for table 8.7

SS2303 (A2)	D1	D2	HV	LOAD	PHASE
1	35,9	34,7	148	100	Ferrite
2	36,2	35,4	144	100	Ferrite
3	34,2	34,5	157	100	Ferrite
4	35,4	35,1	149	100	Ferrite
5	33,5	32,8	168	100	Ferrite
6	33,2	34,6	161	100	Ferrite
7	35,7	35	148	100	Ferrite
8	35,1	35,1	150	100	Ferrite
9	35	35	151	100	Ferrite
10	34,1	33,5	162	100	Ferrite

Table 8.9: Micro hardness results with 100 N load for SS2303

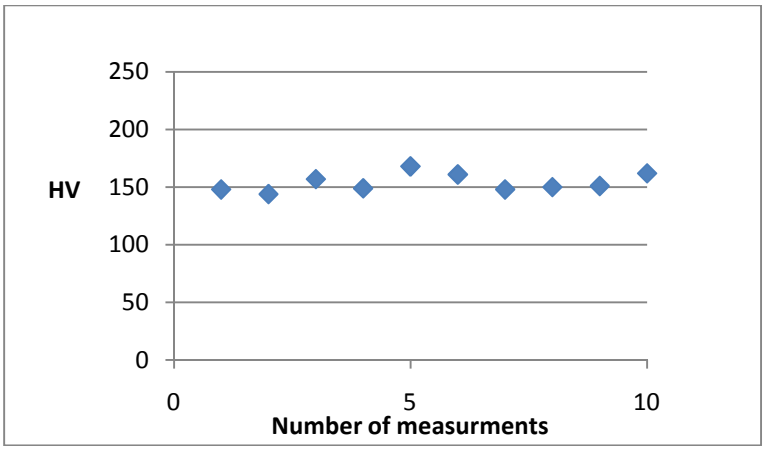


Fig 8.5: Micro hardness diagram for table 8.9

Quantiles		
100,0%	maximum	168
99,5%		168
97,5%		168
90,0%		167,4
75,0%	quartile	161,25
50,0%	median	150,5
25,0%	quartile	148
10,0%		144,4
2,5%		144
0,5%		144
0,0%	minimum	144

Moments	
Mean	153,8
Std Dev	7,7430973
Std Err Mean	2,4485824
Upper 95% Mean	159,33908
Lower 95% Mean	148,26092
N	10

Fitted Normal
Parameter Estimates

Type	Parameter	Estimate	Lower 95%	Upper 95%
Location	μ	153,8	148,26092	159,33908
Dispersion	σ	7,7430973	5,3259749	14,135877

Tables 8.10: statistical data for table 8.9

SS 1672:

SS1672 (B2)	D1	D2	HV	LOAD	PHASE
1	5,8	6,3	253	5	Mix
2	5,5	6	280	5	
3	6,3	6,2	237	5	
4	6,5	7,6	186	5	
5	5,9	5,8	270	5	
6	6,4	6,2	233	5	
7	6,8	7,2	189	5	
8	5,9	6,7	233	5	
9	7,2	6,6	194	5	
10	6,4	6,3	229	5	

Table 8.11: Micro hardness results with 5 N load for SS1672

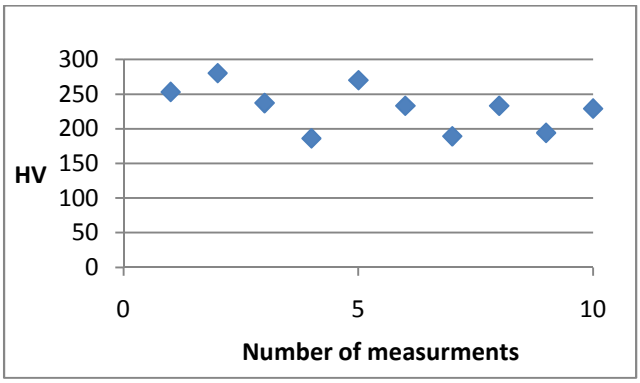


Fig 8.6: Micro hardness diagram for table 8.11

Quantiles		
100,0%	maximum	280
99,5%		280
97,5%		280
90,0%		279
75,0%	quartile	257,25
50,0%	median	233
25,0%	quartile	192,75
10,0%		186,3
2,5%		186
0,5%		186
0,0%	minimum	186

Moments	
Mean	230,4
Std Dev	32,674149
Std Err Mean	10,332473
Upper 95% Mean	253,77368
Lower 95% Mean	207,02632
N	10

Fitted Normal
Parameter Estimates

Type	**Parameter**	**Estimate**	**Lower 95%**	**Upper 95%**
Location	μ	230,4	207,02632	253,77368
Dispersion	σ	32,674149	22,47443	59,650259

Tables 8.12: statistical data for table 8.11

SS1672 (B2)	D1	D2	HV	LOAD	PHASE
1	10	10,5	264	15	
2	10,6	10,4	252	15	
3	10,4	10,8	247	15	
4	9,7	9,8	292	15	
5	9,8	10	283	15	
6	10,5	10,9	242	15	
7	9,9	10,1	278	15	
8	9,9	10,9	257	15	
9	9,9	9,6	292	15	
10	10,5	10,8	245	15	

Table 8.13: Micro hardness results with 15 N load for SS1672

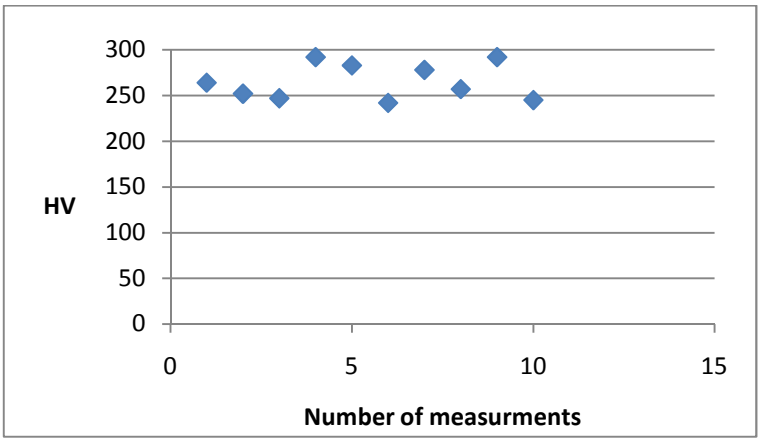


Fig 8.7: Micro hardness diagram for table 8.13

Quantiles		
100,0%	maximum	292
99,5%		292
97,5%		292
90,0%		292
75,0%	quartile	285,25
50,0%	median	260,5
25,0%	quartile	246,5
10,0%		242,3
2,5%		242
0,5%		242
0,0%	minimum	242

Moments	
Mean	265,2
Std Dev	19,543683
Std Err Mean	6,1802553
Upper 95% Mean	279,18071
Lower 95% Mean	251,21929
N	10

Fitted Normal
Parameter Estimates

Type	Parameter	Estimate	Lower 95%	Upper 95%
Location	μ	265,2	251,21929	279,18071
Dispersion	σ	19,543683	13,442833	35,679147

Tables 8.14: statistical data for table 8.13

SS1672 (B2)	D1	D2	HV	LOAD	PHASE
1	12,9	13,6	264	25	
2	13,1	11,8	299	25	
3	13,6	12,8	266	25	
4	13,3	12,1	287	25	
5	13,2	13,7	256	25	
6	13,5	13,2	260	25	
7	12,8	12,9	280	25	
8	13,1	13,4	264	25	
9	13,5	12,5	274	25	
10	13,2	13,5	260	25	

Table 8.15: Micro hardness results with 25 N load for SS1672

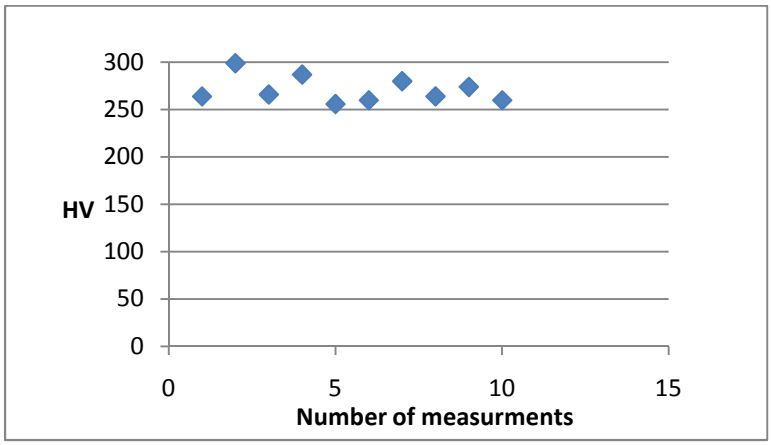


Fig 8.8: Micro hardness diagram for table 8.15

Quantiles		
100,0%	maximum	299
99,5%		299
97,5%		299
90,0%		297,8
75,0%	quartile	281,75
50,0%	median	265
25,0%	quartile	260
10,0%		256,4
2,5%		256
0,5%		256
0,0%	minimum	256

Moments	
Mean	271
Std Dev	13,824294
Std Err Mean	4,3716257
Upper 95% Mean	280,8893
Lower 95% Mean	261,1107
N	10

Fitted Normal

Parameter Estimates

Type	Parameter	Estimate	Lower 95%	Upper 95%
Location	μ	271	261,1107	280,8893
Dispersion	σ	13,824294	9,5088363	25,237772

Tables 8.16: statistical data for table 8.15

SS1672 (B2)	D1	D2	HV	LOAD	PHASE
1	18,8	18,9	260	50	
2	18,8	18,4	268	50	
3	18,8	19,9	247	50	
4	18,5	19,3	259	50	
5	18,9	19,6	250	50	
6	18,7	18,9	262	50	
7	18	18,2	283	50	
8	19,3	19,3	248	50	
9	18,5	19,2	260	50	
10	18	18,8	273	50	

Table 8.17: Micro hardness results with 50 N load for SS1672

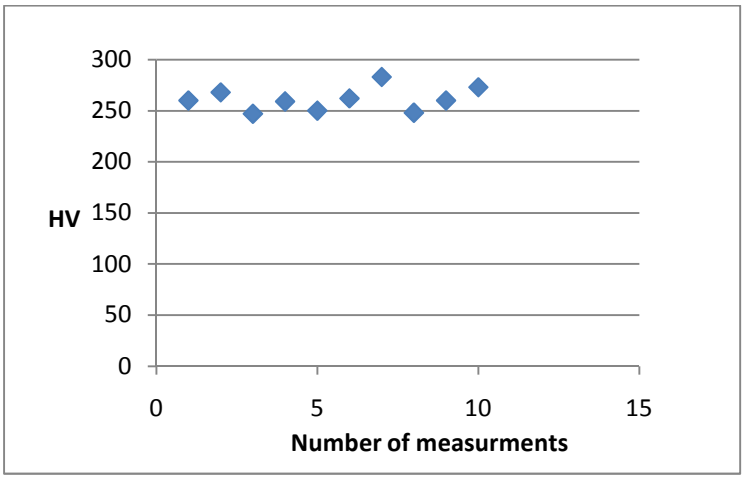


Fig 8.9: Micro hardness diagram for table 8.17

Quantiles		
100,0%	maximum	283
99,5%		283
97,5%		283
90,0%		282
75,0%	quartile	269,25
50,0%	median	260
25,0%	quartile	249,5
10,0%		247,1
2,5%		247
0,5%		247
0,0%	minimum	247

Moments	
Mean	261
Std Dev	11,401754
Std Err Mean	3,6055513
Upper 95% Mean	269,15632
Lower 95% Mean	252,84368
N	10

Fitted Normal
Parameter Estimates

Type	Parameter	Estimate	Lower 95%	Upper 95%
Location	μ	261	252,84368	269,15632
Dispersion	σ	11,401754	7,842528	20,815159

Tables 8.18: statistical data for table 8.17

SS1672 (B2)	D1	D2	HV	LOAD	PHASE
1	26,6	26,5	263	100	
2	27,1	27,6	247	100	
3	26,4	27,6	254	100	
4	27,3	27,3	248	100	
5	27,6	28,1	234	100	
6	27	27,7	247	100	
7	28,2	28,1	234	100	
8	27,5	29	232	100	
9	26,9	25,6	269	100	
10	27,3	27,7	245	100	

Table 8.19: Micro hardness results with 100 N load for SS1672

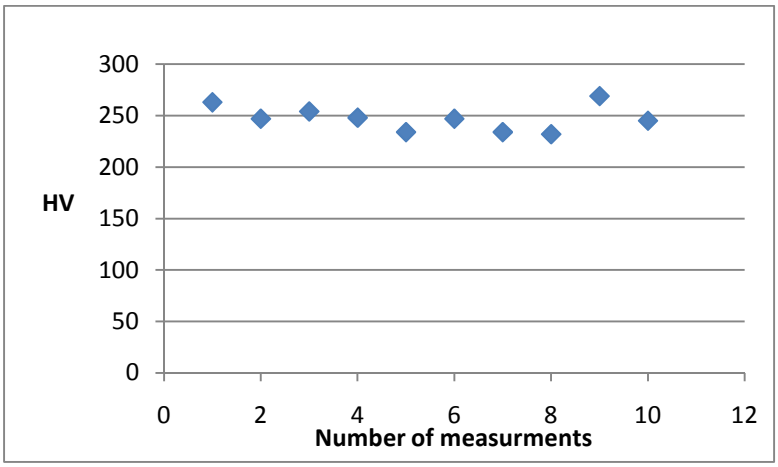


Fig 8.10: Micro hardness diagram for table 8.19

Quantiles		
100,0%	maximum	269
99,5%		269
97,5%		269
90,0%		268,4
75,0%	quartile	256,25
50,0%	median	247
25,0%	quartile	234
10,0%		232,2
2,5%		232
0,5%		232
0,0%	minimum	232

Moments	
Mean	247,3
Std Dev	12,275088
Std Err Mean	3,8817236
Upper 95% Mean	256,08107
Lower 95% Mean	238,51893
N	10

Fitted Normal
Parameter Estimates

Type	Parameter	Estimate	Lower 95%	Upper 95%
Location	μ	247,3	238,51893	256,08107
Dispersion	σ	12,275088	8,4432375	22,409525

Tables 8.20: statistical data for table 8.19

SS 2348:

SS2348 (C2)	D1	D2	HV	LOAD	PHASE
1	7,5	8	154	5	AUSTENITE
2	8	7,7	150	5	AUSTENITE
3	7,7	7,1	169	5	AUSTENITE
4	7,1	7,6	154	5	AUSTENITE
5	7,7	7,7	156	5	AUSTENITE
6	8	7,6	152	5	AUSTENITE
7	7,7	7,3	164	5	AUSTENITE
8	7,7	7,4	162	5	AUSTENITE
9	7,4	8	156	5	AUSTENITE
10	7,6	7,2	169	5	AUSTENITE

Table 8.21.: Micro hardness results with 5 N load for SS2348

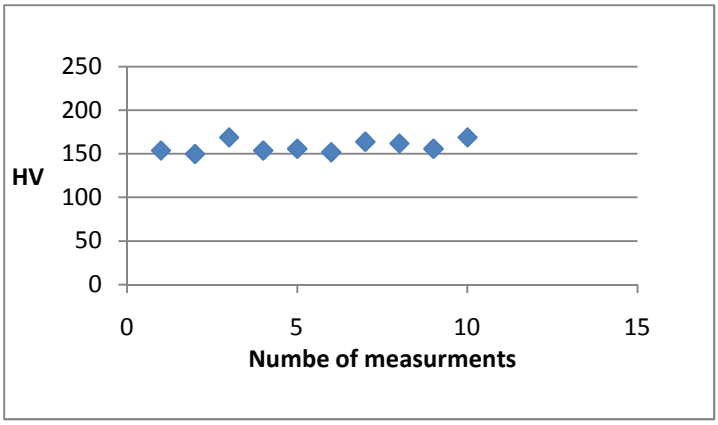


Fig 8.11: Micro hardness diagram for table 8.21

Quantiles		
100,0%	maximum	169
99,5%		169
97,5%		169
90,0%		169
75,0%	quartile	165,25
50,0%	median	156
25,0%	quartile	153,5
10,0%		150,2
2,5%		150
0,5%		150
0,0%	minimum	150

Moments	
Mean	158,6
Std Dev	6,9153613
Std Err Mean	2,1868293
Upper 95% Mean	163,54695
Lower 95% Mean	153,65305
N	10

Fitted Normal
Parameter Estimates

Type	Parameter	Estimate	Lower 95%	Upper 95%
Location	μ	158,6	153,65305	163,54695
Dispersion	σ	6,9153613	4,756629	12,624754

Tables 8.22: statistical data for table 8.21

SS2348 (C2)	D1	D2	HV	LOAD	PHASE
1	12,8	13,2	164	15	AUSTENITE
2	13,2	13,1	160	15	AUSTENITE
3	13,1	13	163	15	AUSTENITE
4	13,2	12,9	163	15	AUSTENITE
5	12,6	12,3	179	15	AUSTENITE
6	12,9	12,5	172	15	AUSTENITE
7	12,5	13,2	168	15	AUSTENITE
8	12,8	13,2	164	15	AUSTENITE
9	13,9	13,3	150	15	AUSTENITE
10	13,2	12,3	171	15	AUSTENITE

Table 8.23: Micro hardness results with 15 N load for SS2348

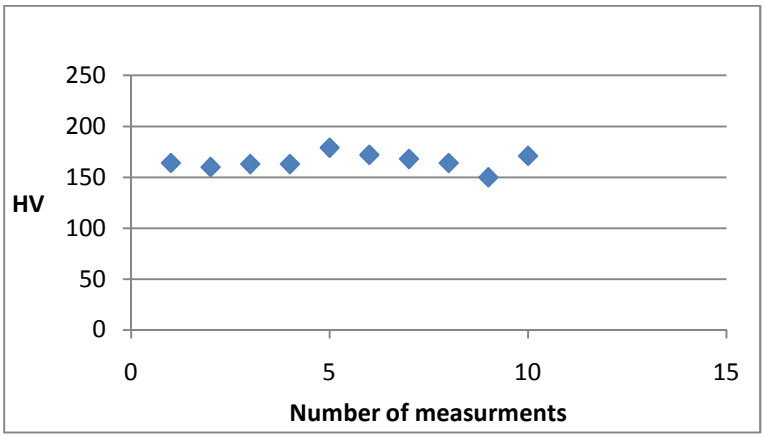


Fig 8.12: Micro hardness diagram for table 8.23

Quantiles		
100,0%	maximum	179
99,5%		179
97,5%		179
90,0%		178,3
75,0%	quartile	171,25
50,0%	median	164
25,0%	quartile	162,25
10,0%		151
2,5%		150
0,5%		150
0,0%	minimum	150

Moments	
Mean	165,4
Std Dev	7,8059806
Std Err Mean	2,4684678
Upper 95% Mean	170,98406
Lower 95% Mean	159,81594
N	10

Fitted Normal
Parameter Estimates

Type	**Parameter**	**Estimate**	**Lower 95%**	**Upper 95%**
Location	μ	165,4	159,81594	170,98406
Dispersion	σ	7,8059806	5,3692283	14,250678

Tables 8.24: statistical data for table 8.23

SS2348 (C2)	D1	D2	HV	LOAD	PHASE
1	17	17,4	156	25	AUSTENITE
2	17,7	16,8	155	25	AUSTENITE
3	16,6	18	154	25	AUSTENITE
4	16,8	16,8	164	25	AUSTENITE
5	17,2	16,9	159	25	AUSTENITE
6	17,1	17,1	158	25	AUSTENITE
7	17,3	17,2	155	25	AUSTENITE
8	16,5	17,3	162	25	AUSTENITE
9	17,6	17,3	152	25	AUSTENITE
10	16,5	17	165	25	AUSTENITE

TABEL 8.25: Micro hardness results with 25 N load for SS2348

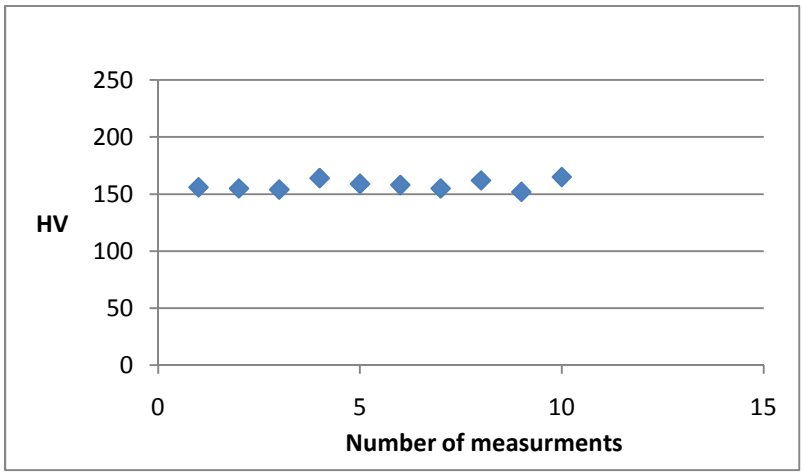


Fig 8.13: Micro hardness diagram for table 8.25

Quantiles		
100,0%	maximum	165
99,5%		165
97,5%		165
90,0%		164,9
75,0%	quartile	162,5
50,0%	median	157
25,0%	quartile	154,75
10,0%		152,2
2,5%		152
0,5%		152
0,0%	minimum	152

Moments	
Mean	158
Std Dev	4,4221664
Std Err Mean	1,3984118
Upper 95% Mean	161,16343
Lower 95% Mean	154,83657
N	10

Fitted Normal
Parameter Estimates

Type	Parameter	Estimate	Lower 95%	Upper 95%
Location	μ	158	154,83657	161,16343
Dispersion	σ	4,4221664	3,0417217	8,073152

Tables 8.26: statistical data for table 8.25

SS2348 (C2)	D1	D2	HV	LOAD	PHASE
1	23,3	23,3	170	50	AUSTENITE
2	26	25,5	139	50	AUSTENITE
3	24	24,5	157	50	AUSTENITE
4	24,1	24	160	50	AUSTENITE
5	25	25,1	147	50	AUSTENITE
6	24	24,4	158	50	AUSTENITE
7	24	25,6	150	50	AUSTENITE
8	22,8	24,4	166	50	AUSTENITE
9	25,6	26	139	50	AUSTENITE
10	23,2	25,1	158	50	AUSTENITE

Table 8.27: Micro hardness results with 50 N load for SS2348

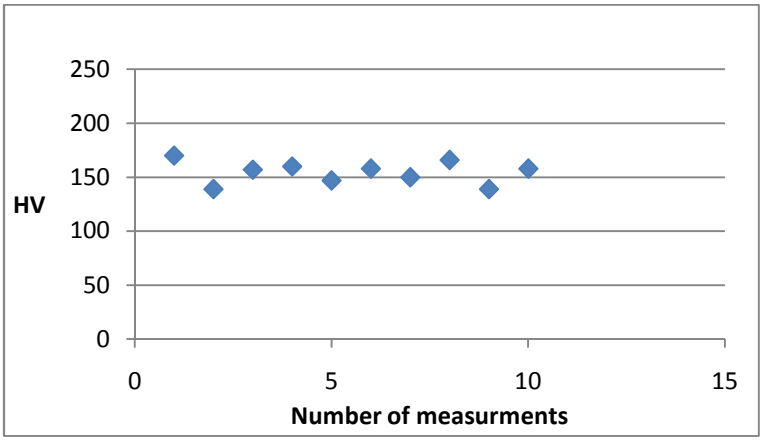


Fig 8.14: Micro hardness diagram for table 8.27

Quantiles		
100,0%	maximum	170
99,5%		170
97,5%		170
90,0%		169,6
75,0%	quartile	161,5
50,0%	median	157,5
25,0%	quartile	145
10,0%		139
2,5%		139
0,5%		139
0,0%	minimum	139

Moments	
Mean	154,4
Std Dev	10,490207
Std Err Mean	3,3172947
Upper 95% Mean	161,90424
Lower 95% Mean	146,89576
N	10

Fitted Normal

Parameter Estimates

Type	Parameter	Estimate	Lower 95%	Upper 95%
Location	μ	154,4	146,89576	161,90424
Dispersion	σ	10,490207	7,2155338	19,151029

Tables 8.28: statistical data for table 8.27

SS2348 (C2)	D1	D2	HV	LOAD	PHASE
1	33,7	35,4	155	100	AUSTENITE
2	35,3	36,8	142	100	AUSTENITE
3	34,5	36	149	100	AUSTENITE
4	35,3	36,3	144	100	AUSTENITE
5	34,2	34,4	157	100	AUSTENITE
6	35,4	37,7	150	100	AUSTENITE
7	34,8	34,5	154	100	AUSTENITE
8	37,2	34,9	142	100	AUSTENITE
9	34,3	35,3	153	100	AUSTENITE
10	35,9	35	147	100	AUSTENITE

Table 8.29: Micro hardness results with 100 N load for SS2348

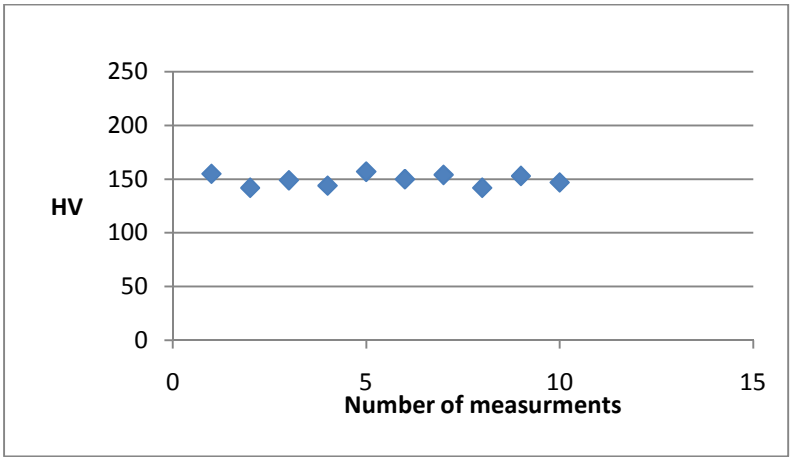


Fig 8.15: Micro hardness diagram for table 8.29

Quantiles		
100,0%	maximum	157
99,5%		157
97,5%		157
90,0%		156,8
75,0%	quartile	154,25
50,0%	median	149,5
25,0%	quartile	143,5
10,0%		142
2,5%		142
0,5%		142
0,0%	minimum	142

Moments	
Mean	149,3
Std Dev	5,4579198
Std Err Mean	1,7259458
Upper 95% Mean	153,20436
Lower 95% Mean	145,39564
N	10

Fitted Normal
Parameter Estimates

Type	Parameter	Estimate	Lower 95%	Upper 95%
Location	μ	149,3	145,39564	153,20436
Dispersion	σ	5,4579198	3,7541494	9,964034

Tables 8.30: statistical data for table 8.29

SAF 2205

SAF2205 (D2)	D1	D2	HV	LOAD	PHASE
1	6,3	6,1	241	5	Austenite
2	5,6	4,9	336	5	Austenite
3	6	6	257	5	Austenite
4	6,3	5,6	261	5	Austenite
5	6,1	6,2	245	5	Austenite
6	6,3	6,4	229	5	Austenite
7	6,1	5,7	266	5	Austenite
8	6,1	6	253	5	Austenite
9	6,1	5,7	266	5	Austenite
10	6	6	257	5	Austenite
11	6	5,7	270	5	Ferrit
12	6,4	6	241	5	Ferrit
13	6,1	6,1	249	5	Ferrit
14	6,4	6,2	233	5	Ferrit
15	6,4	6,3	229	5	Ferrit
16	6,6	5,8	241	5	Ferrit
17	6,5	6,1	233	5	Ferrit
18	6,3	5,6	261	5	Ferrit
19	6,5	6,2	229	5	Ferrit
20	6,1	5,9	257	5	Ferrit
21	7,6	6,9	176	5	Ferrite(near the grain boundary)

Table 8.31: Micro hardness results with 5 N load for SAF 2205

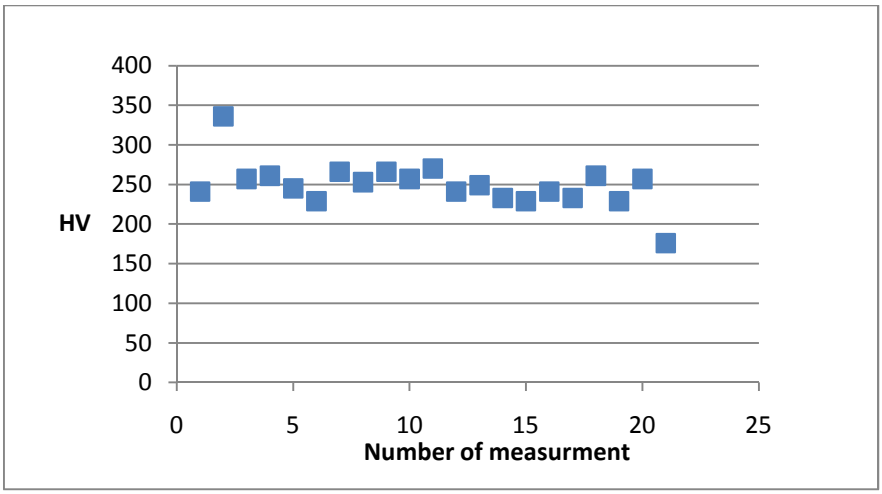


Fig 8.16: Micro hardness diagram for table 8.31

Quantiles		
100,0%	maximum	336
99,5%		336
97,5%		336
90,0%		269,6
75,0%	quartile	261
50,0%	median	251
25,0%	quartile	235
10,0%		229
2,5%		229
0,5%		229
0,0%	minimum	229

Moments	
Mean	252,7
Std Dev	23,764414
Std Err Mean	5,3138845
Upper 95% Mean	263,82209
Lower 95% Mean	241,57791
N	20

Fitted Normal
Parameter Estimates

Type	Parameter	Estimate	Lower 95%	Upper 95%
Location	μ	252,7	241,57791	263,82209
Dispersion	σ	23,764414	18,072609	34,709629

Tables 8.32: statistical data for table 8.31

SAF2205 (D2)	D1	D2	HV	LOAD	PHASE
1	11,1	10,8	231	15	Austenite
2	10,5	10,1	262	15	Austenite
3	9,1	8,9	343	15	Austenite
4	10,6	10,4	252	15	Austenite
5	10,9	10,8	236	15	Austenite
6	10,7	10,3	252	15	Austenite
7	10,1	9,9	278	15	Austenite
8	10,7	10,4	249	15	Austenite
9	10,9	10,8	236	15	Austenite
10	8,3	9,6	347	15	Austenite
11	10	10,2	272	15	Ferrit
12	19,6	20	70,9	15	Ferrit
13	10,8	9,7	264	15	Ferrit
14	10,7	10,3	252	15	Ferrit
15	10,6	10,2	257	15	Ferrit
16	10,6	9,9	264	15	Ferrit
17	10,1	10,1	272	15	Ferrit
18	10,1	9,8	280	15	Ferrit
19	10,8	10,8	238	15	Ferrit
20	10,2	10,4	262	15	Ferrit

Table 8.33: Micro hardness results with 15 N load for SAF 2205

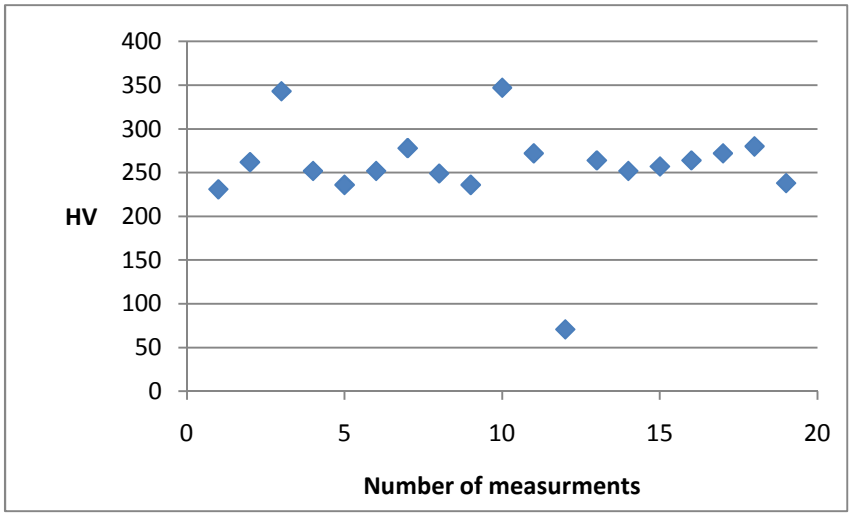


Fig 8.17: Micro hardness diagram for table 8.33

Quantiles		
100,0%	maximum	347
99,5%		347
97,5%		347
90,0%		343
75,0%	quartile	272
50,0%	median	262
25,0%	quartile	249
10,0%		236
2,5%		231
0,5%		231
0,0%	minimum	231

Moments	
Mean	265,63158
Std Dev	31,363834
Std Err Mean	7,1953569
Upper 95% Mean	280,74846
Lower 95% Mean	250,5147
N	19

Fitted Normal
Parameter Estimates

Type	**Parameter**	**Estimate**	**Lower 95%**	**Upper 95%**
Location	μ	265,63158	250,5147	280,74846
Dispersion	σ	31,363834	23,698909	46,381607

Tables 8.34: statistical data for table 8.33

SAF2205 (D2)	D1	D2	HV	LOAD	PHASE
1	12,8	13,1	276	25	Austenite
2	13,1	13,1	270	25	Austenite
3	11,5	10,5	383	25	Austenite
4	13,1	13,5	262	25	Austenite
5	11,9	12,06	308	25	Austenite
6	13,1	13,1	270	25	Austenite
7	12,7	12,6	289	25	Austenite
8	12,7	12,3	296	25	Austenite
9	13,5	13,5	254	25	Austenite
10	13,2	13,1	268	25	Austenite
11	13,2	13,1	268	25	Ferrit
12	13	12,7	280	25	Ferrit
13	13,1	12,9	274	25	Ferrit
14	13,3	13,5	258	25	Ferrit
15	13,8	13	258	25	Ferrit
16	13,5	13,3	258	25	Ferrit
17	13,2	12,8	274	25	Ferrit
18	13,2	13,2	266	25	Ferrit
19	13,1	12,7	278	25	Ferrit
20	12,5	11,6	319	25	Ferrit

Table 8.35: Micro hardness results with 25 N load for SAF 2205

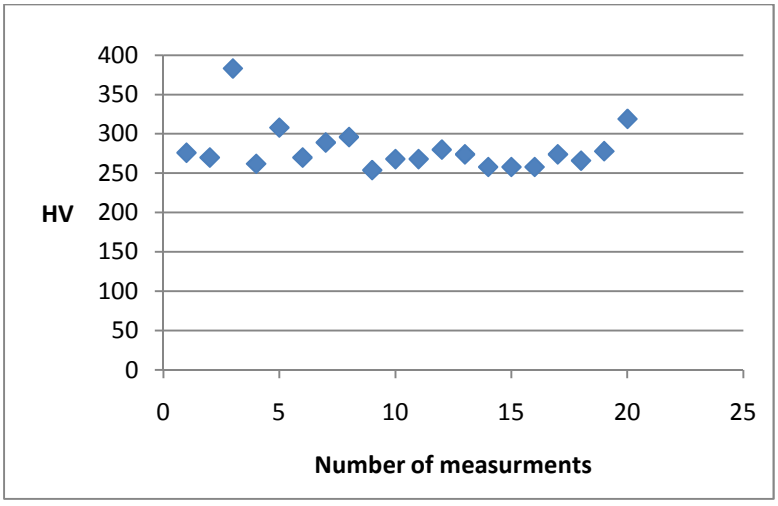


Fig 8.18: Micro hardness diagram for table 8.35

Quantiles		
100,0%	maximum	383
99,5%		383
97,5%		383
90,0%		317,9
75,0%	quartile	286,75
50,0%	median	272
25,0%	quartile	263
10,0%		258
2,5%		254
0,5%		254
0,0%	minimum	254

Moments	
Mean	280,45
Std Dev	29,446606
Std Err Mean	6,5844614
Upper 95% Mean	294,23144
Lower 95% Mean	266,66856
N	20

Fitted Normal
Parameter Estimates

Type	Parameter	Estimate	Lower 95%	Upper 95%
Location	μ	280,45	266,66856	294,23144
Dispersion	σ	29,446606	22,393861	43,008878

Tables 8.36: statistical data for table 8.35

SAF2205 (D2)	D1	D2	HV	LOAD	PHASE
1	16	17,1	338	50	Austenite
2	18,9	19,5	251	50	Austenite
3	19,9	18,9	246	50	Austenite
4	19,1	18,3	265	50	Austenite
5	17,9	18,3	283	50	Austenite
6	19,6	18,7	252	50	Austenite
7	17,6	17,4	302	50	Austenite
8	19,5	19,5	243	50	Austenite
9	19	18,2	268	50	Austenite
10	18,7	18,5	268	50	Austenite
11	19,5	19,1	248	50	Ferrit
12	19,4	20,4	234	50	Ferrit
13	19,1	19,6	247	50	Ferrit
14	19,1	19,2	252	50	Ferrite
15	19,1	19,7	246	50	Ferrite
16	19	17,2	283	50	Ferrite
17	18,7	18,7	265	50	Ferrite
18	19	18,4	265	50	Ferrite
19	19,3	17,8	269	50	Ferrite
20	19	18,3	266	50	Ferrite

Table 8.37: Micro hardness results with 50 N load for SAF 2205

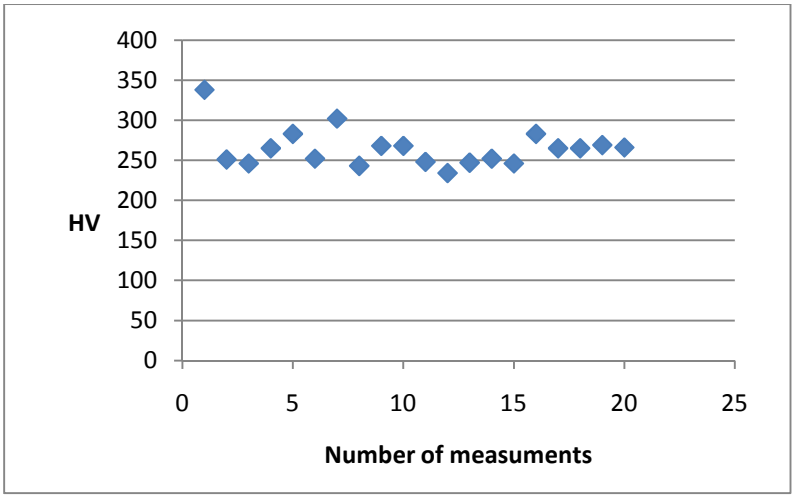


Fig 8.19: Micro hardness diagram for table 8.37

Quantiles		
100,0%	maximum	338
99,5%		338
97,5%		338
90,0%		300,1
75,0%	quartile	268,75
50,0%	median	265
25,0%	quartile	247,25
10,0%		243,3
2,5%		234
0,5%		234
0,0%	minimum	234

Moments	
Mean	264,55
Std Dev	23,72091
Std Err Mean	5,3041568
Upper 95% Mean	275,65173
Lower 95% Mean	253,44827
N	20

Fitted Normal
Parameter Estimates

Type	**Parameter**	**Estimate**	**Lower 95%**	**Upper 95%**
Location	μ	264,55	253,44827	275,65173
Dispersion	σ	23,72091	18,039524	34,646089

Tables 8.38: statistical data for table 8.37

SAF2205 (D2)	D1	D2	HV	LOAD	PHASE
1	25,2	26,8	274	100	Austenite
2	27,9	28,8	230	100	Austenite
3	26,8	28,3	244	100	Austenite
4	28,4	24,7	263	100	Austenite
5	26,7	26	267	100	Austenite
6	24,3	26,5	282	100	Austenite
7	28,1	27,2	242	100	Austenite
8	28,4	29,4	222	100	Austenite
9	26,1	25,1	282	100	Austenite
10	27,5	27,1	248	100	Austenite
11	27,8	28,5	234	100	Ferrite
12	28,6	27,6	234	100	Ferrite
13	28,4	27,6	236	100	Ferrite
14	27,2	27,9	244	100	Ferrite
15	27,2	26,7	255	100	Ferrite
16	27,7	27,6	242	100	Ferrite
17	27,2	28,1	242	100	Ferrite
18	28,4	26,9	242	100	Ferrite
19	27,7	29,2	229	100	Ferrite
20	27,7	28	239	100	Ferrite

TABEL 8.38: Micro hardness results with 100 N load for SAF 2205

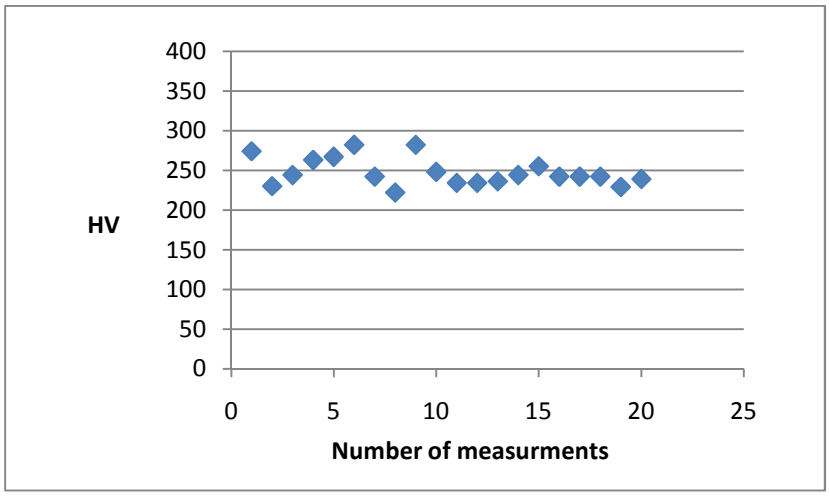


Fig 8.20: Micro hardness diagram for table 8.38

Quantiles		
100,0%	maximum	282
99,5%		282
97,5%		282
90,0%		281,2
75,0%	quartile	261
50,0%	median	242
25,0%	quartile	234,5
10,0%		229,1
2,5%		222
0,5%		222
0,0%	minimum	222

Moments	
Mean	247,55
Std Dev	17,430992
Std Err Mean	3,8976882
Upper 95% Mean	255,70796
Lower 95% Mean	239,39204
N	20

Fitted Normal
Parameter Estimates

Type	Parameter	Estimate	Lower 95%	Upper 95%
Location	μ	247,55	239,39204	255,70796
Dispersion	σ	17,430992	13,256102	25,459212

Tables 8.39: statistical data for table 8.38

Micro hardness measurement results for the surface and center of the plate

SS2303 SURFACE	D1	D2	HV	LOAD
1	12,7	12,7	172	15
2	12,3	11,2	201	15
3	13,3	11,6	179	15
4	12,6	11,6	189	15
5	12,1	12,4	185	15
6	12	12,5	185	15
7	12,4	12,1	185	15
8	12,3	12,1	186	15
9	11,3	11,9	206	15
10	12	11,7	198	15

SS2303 CENTER	D1	D2	HV	LOAD
1	12,6	12,5	176	15
2	12,6	11,9	185	15
3	12,3	12,7	178	15
4	13,1	12,8	165	15
5	12,4	13	172	15
6	13,2	13	162	15
7	13,1	13,1	162	15
8	12,7	12,4	176	15
9	12,4	12,1	185	15
10	12,8	13,1	165	15

Table 8.40: micro hardness results from the surface and center of the plate with 15 N loads for SS2303

SS2303 SURFACE	D1	D2	HV	LOAD
1	15,5	15,5	192	25
2	16,4	15,2	185	25
3	15,5	15,2	192	25
4	16,6	16,5	169	25
5	16	15,8	183	25
6	15	15	206	25
7	15,9	15,6	186	25
8	14,7	14,6	216	25
9	15,4	14,6	206	25
10	16,2	15,4	185	25

SS2303 CENTER	D1	D2	HV	LOAD
1	16,8	16,4	168	25
2	15,9	16	182	25
3	15,9	16	182	25
4	15,7	16,6	177	25
5	17,1	16,9	160	25
6	17	17,1	159	25
7	16,4	16,4	172	25
8	16,1	17	169	25
9	16	16	181	25
10	15,9	16,4	177	25

Table 8.41: micro hardness results from the surface and center of the plate with 25 N loads for SS2303

SS2348 SURFACE	D1	D2	HV	LOAD
1	12,8	12,5	173	15
2	12,3	11,9	189	15
3	13,3	12,5	165	15
4	13,1	12,4	171	15
5	13,3	13,2	158	15
6	13,2	12,8	164	15
7	13,2	12,8	164	15
8	13,3	13,1	159	15
9	13,2	12,4	169	15
10	13,4	12,8	162	15

SS2348 CENTER	D1	D2	HV	LOAD
1	13,8	13,8	146	15
2	14,3	14,1	137	15
3	13,6	13,5	151	15
4	14,3	14,4	135	15
5	12,8	13,5	160	15
6	13,1	13,2	160	15
7	13,5	13,9	148	15
8	13,2	13,5	156	15
9	13,9	14,3	139	15
10	12,8	13,1	165	15

Table 8.42: micro hardness results from the surface and center of the plate with 15 N loads for SS2348

SS2348 SURFACE	D1	D2	HV	LOAD
1	16,9	16,2	169	25
2	16,5	15,4	182	25
3	16,8	16,2	170	25
4	16,4	16,7	169	25
5	17,1	17,1	158	25
6	15,9	15,9	183	25
7	16,7	16,4	169	25
8	16,3	15,5	183	25
9	15,6	16,5	179	25
10	16,4	15,9	177	25

SS2348 CENTER	D1	D2	HV	LOAD
1	18,1	17,3	147	25
2	17,5	17,4	152	25
3	16,9	16,4	167	25
4	17,9	17,5	147	25
5	16,8	17	162	25
6	18	17,7	145	25
7	17,9	17,9	144	25
8	17	16,5	165	25
9	17,8	17,9	145	25
10	16,7	17,2	161	25

Table 8.42: micro hardness results from the surface and center of the plate with 25 N loads for SS2348

Alloy 718 Large Grains Solution (surface)

Depth		**D1 (µm)**	**D2 (µm)**	**Hardness**		**Load (gf)**	**Obj**
0,00	mm	30,71	29,61	203,9	HV	100	40x
0,00	mm	29,61	29,33	213,5	HV	100	40x
0,00	mm	30,57	28,64	211,5	HV	100	40x
0,00	mm	29,06	28,23	226,0	HV	100	40x
0,00	mm	29,61	29,47	212,5	HV	100	40x
0,00	mm	33,60	35,67	154,6	HV	100	40x
0,00	mm	31,40	32,22	183,2	HV	100	40x
0,00	mm	32,91	32,36	174,1	HV	100	40x
0,00	mm	31,81	31,54	184,8	HV	100	40x
0,00	mm	31,81	32,91	177,1	HV	100	40x
0,15	mm	30,99	30,30	197,5	HV	100	40x
0,15	mm	30,85	30,43	197,5	HV	100	40x
0,15	mm	30,57	30,71	197,5	HV	100	40x
0,15	mm	29,88	30,02	206,7	HV	100	40x
0,15	mm	30,30	31,12	196,6	HV	100	40x
0,15	mm	32,22	33,46	171,9	HV	100	40x
0,15	mm	29,47	30,71	204,8	HV	100	40x
0,15	mm	31,81	31,12	187,3	HV	100	40x
0,15	mm	31,81	31,81	183,2	HV	100	40x
0,15	mm	33,05	31,54	177,8	HV	100	40x
0,30	mm	31,54	29,61	198,4	HV	100	40x
0,30	mm	30,99	30,43	196,6	HV	100	40x
0,30	mm	30,16	29,47	208,6	HV	100	40x
0,30	mm	30,43	30,57	199,3	HV	100	40x
0,30	mm	29,61	30,85	203,0	HV	100	40x
0,30	mm	30,71	30,02	201,1	HV	100	40x
0,30	mm	29,47	30,85	203,9	HV	100	40x
0,30	mm	31,67	30,30	193,2	HV	100	40x
0,30	mm	27,82	28,64	232,7	HV	100	40x

0,30	mm	29,75	30,30	205,8	HV	100	40x
0,45	mm	31,54	29,75	197,5	HV	100	40x
0,45	mm	31,95	31,40	184,8	HV	100	40x
0,45	mm	30,43	31,26	194,9	HV	100	40x
0,45	mm	30,16	29,75	206,7	HV	100	40x
0,45	mm	32,22	30,16	190,6	HV	100	40x
0,45	mm	30,30	30,16	203,0	HV	100	40x
0,45	mm	29,61	30,43	205,8	HV	100	40x
0,45	mm	31,12	29,88	199,3	HV	100	40x
0,45	mm	30,71	30,57	197,5	HV	100	40x
0,45	mm	31,40	30,16	195,8	HV	100	40x
0,60	mm	30,99	30,43	196,6	HV	100	40x
0,60	mm	30,85	30,85	194,9	HV	100	40x
0,60	mm	29,88	29,33	211,5	HV	100	40x
0,60	mm	29,47	29,47	213,5	HV	100	40x
0,60	mm	29,06	28,92	220,7	HV	100	40x
0,60	mm	30,57	30,30	200,2	HV	100	40x
0,60	mm	29,19	29,19	217,6	HV	100	40x
0,60	mm	31,12	29,88	199,3	HV	100	40x
0,60	mm	30,57	30,43	199,3	HV	100	40x
0,60	mm	29,47	30,02	209,6	HV	100	40x
0,75	mm	30,71	29,61	203,9	HV	100	40x
0,75	mm	30,02	29,75	207,7	HV	100	40x
0,75	mm	30,99	29,61	202,0	HV	100	40x
0,75	mm	30,43	30,16	202,0	HV	100	40x
0,75	mm	31,81	30,71	189,8	HV	100	40x
0,75	mm	29,61	29,88	209,6	HV	100	40x
0,75	mm	29,61	29,47	212,5	HV	100	40x
0,75	mm	31,67	30,30	193,2	HV	100	40x
0,75	mm	29,06	29,33	217,6	HV	100	40x
0,75	mm	29,33	29,33	215,5	HV	100	40x
0,90	mm	29,88	30,57	203,0	HV	100	40x
0,90	mm	30,02	29,47	209,6	HV	100	40x
0,90	mm	31,26	30,16	196,6	HV	100	40x
0,90	mm	30,71	31,12	194,0	HV	100	40x
0,90	mm	29,33	30,57	206,7	HV	100	40x
0,90	mm	31,12	31,12	191,4	HV	100	40x
0,90	mm	30,71	31,54	191,4	HV	100	40x
0,90	mm	31,26	30,99	191,4	HV	100	40x
0,90	mm	30,16	29,75	206,7	HV	100	40x
0,90	mm	30,99	30,99	193,2	HV	100	40x
1,05	mm	29,06	28,78	221,7	HV	100	40x
1,05	mm	31,26	30,16	196,6	HV	100	40x
1,05	mm	30,43	29,61	205,8	HV	100	40x
1,05	mm	30,99	31,40	190,6	HV	100	40x
1,05	mm	30,85	30,16	199,3	HV	100	40x
1,05	mm	30,99	29,06	205,8	HV	100	40x
1,05	mm	29,33	29,06	217,6	HV	100	40x
1,05	mm	29,88	30,43	203,9	HV	100	40x
1,05	mm	29,88	30,43	203,9	HV	100	40x
1,05	mm	29,19	28,92	219,6	HV	100	40x

1,20	mm	31,40	29,88	197,5	HV	100	40x
1,20	mm	31,40	31,12	189,8	HV	100	40x
1,20	mm	30,85	30,30	198,4	HV	100	40x
1,20	mm	29,19	28,37	223,9	HV	100	40x
1,20	mm	30,57	30,16	201,1	HV	100	40x
1,20	mm	23,69	22,31	350,6	HV	100	40x
1,20	mm	29,88	30,57	203,0	HV	100	40x
1,20	mm	30,85	30,99	194,0	HV	100	40x
1,20	mm	30,30	29,47	207,7	HV	100	40x
1,20	mm	31,40	30,71	192,3	HV	100	40x
1,35	mm	30,99	30,16	198,4	HV	100	40x
1,35	mm	29,75	30,30	205,8	HV	100	40x
1,35	mm	30,85	30,99	194,0	HV	100	40x
1,35	mm	30,16	29,75	206,7	HV	100	40x
1,35	mm	30,16	29,61	207,7	HV	100	40x
1,35	mm	30,43	29,19	208,6	HV	100	40x
1,35	mm	30,43	30,30	201,1	HV	100	40x
1,35	mm	29,19	30,02	211,5	HV	100	40x
1,35	mm	29,61	31,26	200,2	HV	100	40x
1,35	mm	30,30	30,16	203,0	HV	100	40x

Table 8.43: micro hardness measurements results with 100 N load from the surface of the plate for alloy718 LGS

Alloy 718 Large Grains Solution (center)

Depth		**D1 (µm)**	**D2 (µm)**	**Hardness**		**Load (gf)**	**Obj**
0,00	mm	30,16	29,47	208,6	HV	100	40x
0,00	mm	30,16	30,16	203,9	HV	100	40x
0,00	mm	30,16	30,99	198,4	HV	100	40x
0,00	mm	31,26	31,26	189,8	HV	100	40x
0,00	mm	29,19	28,64	221,7	HV	100	40x
0,00	mm	28,09	28,64	230,4	HV	100	40x
0,00	mm	30,43	29,33	207,7	HV	100	40x
0,00	mm	30,16	31,12	197,5	HV	100	40x
0,00	mm	29,88	29,47	210,6	HV	100	40x
0,00	mm	29,06	29,88	213,5	HV	100	40x
0,15	mm	29,75	30,99	201,1	HV	100	40x
0,15	mm	30,43	30,57	199,3	HV	100	40x
0,15	mm	30,30	29,88	204,8	HV	100	40x
0,15	mm	29,88	30,57	203,0	HV	100	40x
0,15	mm	29,06	29,75	214,5	HV	100	40x
0,15	mm	30,99	29,88	200,2	HV	100	40x
0,15	mm	29,19	30,43	208,6	HV	100	40x
0,15	mm	29,47	28,92	217,6	HV	100	40x
0,15	mm	27,40	30,02	224,9	HV	100	40x
0,15	mm	30,30	30,85	198,4	HV	100	40x
0,30	mm	30,71	28,92	208,6	HV	100	40x
0,30	mm	31,12	28,78	206,7	HV	100	40x
0,30	mm	29,75	29,61	210,6	HV	100	40x
0,30	mm	30,16	30,85	199,3	HV	100	40x
0,30	mm	31,26	29,88	198,4	HV	100	40x

0,30	mm	29,33	29,33	215,5	HV	100	40x
0,30	mm	29,19	30,30	209,6	HV	100	40x
0,30	mm	30,43	29,06	209,6	HV	100	40x
0,30	mm	29,47	30,71	204,8	HV	100	40x
0,30	mm	29,47	29,47	213,5	HV	100	40x
0,45	mm	29,61	29,88	209,6	HV	100	40x
0,45	mm	30,43	29,88	203,9	HV	100	40x
0,45	mm	31,40	30,43	194,0	HV	100	40x
0,45	mm	30,02	28,78	214,5	HV	100	40x
0,45	mm	30,02	29,75	207,7	HV	100	40x
0,45	mm	29,88	30,02	206,7	HV	100	40x
0,45	mm	30,43	29,75	204,8	HV	100	40x
0,45	mm	29,88	30,02	206,7	HV	100	40x
0,45	mm	28,78	28,64	224,9	HV	100	40x
0,45	mm	30,99	30,16	198,4	HV	100	40x
0,60	mm	29,75	28,64	217,6	HV	100	40x
0,60	mm	29,75	29,88	208,6	HV	100	40x
0,60	mm	31,12	29,61	201,1	HV	100	40x
0,60	mm	30,57	30,43	199,3	HV	100	40x
0,60	mm	30,85	29,47	203,9	HV	100	40x
0,60	mm	30,99	29,75	201,1	HV	100	40x
0,60	mm	30,43	30,16	202,0	HV	100	40x
0,60	mm	30,43	30,30	201,1	HV	100	40x
0,60	mm	29,88	29,88	207,7	HV	100	40x
0,60	mm	29,88	30,85	201,1	HV	100	40x
0,75	mm	29,19	29,19	217,6	HV	100	40x
0,75	mm	29,88	29,47	210,6	HV	100	40x
0,75	mm	28,09	27,96	236,1	HV	100	40x
0,75	mm	30,02	29,19	211,5	HV	100	40x
0,75	mm	30,30	30,30	202,0	HV	100	40x
0,75	mm	30,16	29,88	205,8	HV	100	40x
0,75	mm	30,02	30,16	204,8	HV	100	40x
0,75	mm	30,30	29,19	209,6	HV	100	40x
0,75	mm	30,71	30,02	201,1	HV	100	40x
0,75	mm	30,85	28,92	207,7	HV	100	40x
0,90	mm	29,61	30,16	207,7	HV	100	40x
0,90	mm	29,75	26,58	233,8	HV	100	40x
0,90	mm	30,99	30,43	196,6	HV	100	40x
0,90	mm	30,85	29,75	202,0	HV	100	40x
0,90	mm	30,02	30,99	199,3	HV	100	40x
0,90	mm	30,57	29,61	204,8	HV	100	40x
0,90	mm	30,57	30,57	198,4	HV	100	40x
0,90	mm	30,30	30,85	198,4	HV	100	40x
0,90	mm	28,23	29,19	224,9	HV	100	40x
0,90	mm	31,26	29,61	200,2	HV	100	40x
1,05	mm	29,88	31,12	199,3	HV	100	40x
1,05	mm	29,33	30,71	205,8	HV	100	40x
1,05	mm	29,06	31,26	203,9	HV	100	40x
1,05	mm	29,75	29,75	209,6	HV	100	40x
1,05	mm	28,92	27,68	231,5	HV	100	40x
1,05	mm	29,19	28,37	223,9	HV	100	40x

1,05	mm	30,30	28,92	211,5	HV	100	40x
1,05	mm	30,43	31,26	194,9	HV	100	40x
1,05	mm	30,16	29,88	205,8	HV	100	40x
1,05	mm	30,71	30,30	199,3	HV	100	40x
1,20	mm	29,19	29,33	216,5	HV	100	40x
1,20	mm	31,12	30,99	192,3	HV	100	40x
1,20	mm	30,99	30,30	197,5	HV	100	40x
1,20	mm	31,54	31,12	188,9	HV	100	40x
1,20	mm	30,71	30,02	201,1	HV	100	40x
1,20	mm	29,06	28,64	222,8	HV	100	40x
1,20	mm	30,02	27,68	222,8	HV	100	40x
1,20	mm	30,71	29,88	202,0	HV	100	40x
1,20	mm	29,61	30,30	206,7	HV	100	40x
1,20	mm	30,99	29,06	205,8	HV	100	40x
1,35	mm	29,19	29,61	214,5	HV	100	40x
1,35	mm	30,16	30,57	201,1	HV	100	40x
1,35	mm	30,57	29,88	203,0	HV	100	40x
1,35	mm	28,37	28,92	226,0	HV	100	40x
1,35	mm	29,88	28,51	217,6	HV	100	40x
1,35	mm	29,19	29,75	213,5	HV	100	40x
1,35	mm	29,47	30,02	209,6	HV	100	40x
1,35	mm	32,09	31,54	183,2	HV	100	40x
1,35	mm	30,99	30,57	195,8	HV	100	40x
1,35	mm	30,30	29,47	207,7	HV	100	40x

Table 8.44: micro hardness measurements results with 100 N load from the center of the plate for alloy718 LGS

Alloy 718 Small Grain Aged (surface)

Depth		**D1 (µm)**	**D2 (µm)**	**Hardness**		**Load (gf)**	**Obj**
0,00	mm	19,97	19,69	471,6	HV	100	40x
0,00	mm	19,83	19,56	478,2	HV	100	40x
0,00	mm	25,89	22,31	319,3	HV	100	40x
0,00	mm	19,56	19,56	484,9	HV	100	40x
0,00	mm	19,56	19,42	488,4	HV	100	40x
0,00	mm	20,24	20,11	455,6	HV	100	40x
0,00	mm	19,83	19,69	474,9	HV	100	40x
0,00	mm	19,56	19,28	491,8	HV	100	40x
0,00	mm	19,69	19,42	484,9	HV	100	40x
0,00	mm	19,56	19,56	484,9	HV	100	40x
0,15	mm	19,97	19,69	471,6	HV	100	40x
0,15	mm	20,11	19,97	461,9	HV	100	40x
0,15	mm	19,56	19,83	478,2	HV	100	40x
0,15	mm	19,28	19,14	502,5	HV	100	40x
0,15	mm	19,56	19,83	478,2	HV	100	40x
0,15	mm	19,56	19,69	481,5	HV	100	40x
0,15	mm	19,42	19,56	488,4	HV	100	40x
0,15	mm	19,97	19,69	471,6	HV	100	40x
0,15	mm	19,69	19,83	474,9	HV	100	40x
0,15	mm	19,14	19,42	498,9	HV	100	40x
0,30	mm	19,97	19,69	471,6	HV	100	40x

0,30	mm	20,11	19,83	465,1	HV	100	40x
0,30	mm	19,42	19,69	484,9	HV	100	40x
0,30	mm	19,28	19,83	484,9	HV	100	40x
0,30	mm	20,11	19,42	474,9	HV	100	40x
0,30	mm	19,56	19,42	488,4	HV	100	40x
0,30	mm	19,28	19,69	488,4	HV	100	40x
0,30	mm	19,56	19,69	481,5	HV	100	40x
0,30	mm	19,42	19,56	488,4	HV	100	40x
0,30	mm	19,14	19,42	498,9	HV	100	40x
0,45	mm	19,69	19,56	481,5	HV	100	40x
0,45	mm	20,24	20,79	440,4	HV	100	40x
0,45	mm	19,28	19,42	495,3	HV	100	40x
0,45	mm	19,42	19,42	491,8	HV	100	40x
0,45	mm	19,56	19,83	478,2	HV	100	40x
0,45	mm	19,69	19,69	478,2	HV	100	40x
0,45	mm	19,83	19,42	481,5	HV	100	40x
0,45	mm	19,42	19,83	481,5	HV	100	40x
0,45	mm	19,69	20,11	468,3	HV	100	40x
0,45	mm	20,11	19,56	471,6	HV	100	40x
0,60	mm	19,28	19,69	488,4	HV	100	40x
0,60	mm	23,14	21,21	377,2	HV	100	40x
0,60	mm	19,56	19,69	481,5	HV	100	40x
0,60	mm	19,83	19,83	471,6	HV	100	40x
0,60	mm	19,14	19,69	491,8	HV	100	40x
0,60	mm	19,97	19,97	465,1	HV	100	40x
0,60	mm	19,56	19,14	495,3	HV	100	40x
0,60	mm	19,83	19,28	484,9	HV	100	40x
0,60	mm	19,28	19,83	484,9	HV	100	40x
0,60	mm	19,69	19,56	481,5	HV	100	40x
0,75	mm	19,28	19,28	498,9	HV	100	40x
0,75	mm	26,17	21,90	321,1	HV	100	40x
0,75	mm	19,56	19,69	481,5	HV	100	40x
0,75	mm	19,28	19,56	491,8	HV	100	40x
0,75	mm	19,83	19,97	468,3	HV	100	40x
0,75	mm	19,42	19,83	481,5	HV	100	40x
0,75	mm	18,18	19,83	513,5	HV	100	40x
0,75	mm	19,69	19,14	491,8	HV	100	40x
0,75	mm	19,69	19,56	481,5	HV	100	40x
0,75	mm	19,56	19,56	484,9	HV	100	40x
0,90	mm	19,28	19,56	491,8	HV	100	40x
0,90	mm	26,03	22,72	312,1	HV	100	40x
0,90	mm	20,11	19,28	478,2	HV	100	40x
0,90	mm	19,83	19,42	481,5	HV	100	40x
0,90	mm	19,56	19,97	474,9	HV	100	40x
0,90	mm	18,87	19,14	513,5	HV	100	40x
0,90	mm	20,52	20,79	434,6	HV	100	40x
0,90	mm	19,83	19,69	474,9	HV	100	40x
0,90	mm	19,28	19,69	488,4	HV	100	40x
0,90	mm	19,97	19,42	478,2	HV	100	40x
1,05	mm	19,28	19,56	491,8	HV	100	40x
1,05	mm	23,14	21,21	377,2	HV	100	40x

1,05	mm	19,83	20,11	465,1	HV	100	40x
1,05	mm	19,83	19,28	484,9	HV	100	40x
1,05	mm	19,56	19,56	484,9	HV	100	40x
1,05	mm	19,69	19,83	474,9	HV	100	40x
1,05	mm	19,28	19,69	488,4	HV	100	40x
1,05	mm	19,42	19,42	491,8	HV	100	40x
1,05	mm	18,87	18,73	524,8	HV	100	40x
1,05	mm	19,14	19,42	498,9	HV	100	40x
1,20	mm	19,42	19,42	491,8	HV	100	40x
1,20	mm	19,69	19,69	478,2	HV	100	40x
1,20	mm	19,42	19,69	484,9	HV	100	40x
1,20	mm	19,28	19,28	498,9	HV	100	40x
1,20	mm	19,56	19,69	481,5	HV	100	40x
1,20	mm	19,56	19,56	484,9	HV	100	40x
1,20	mm	19,56	19,69	481,5	HV	100	40x
1,20	mm	19,97	19,83	468,3	HV	100	40x
1,20	mm	19,56	19,42	488,4	HV	100	40x
1,20	mm	19,56	19,28	491,8	HV	100	40x
1,35	mm	19,83	19,69	474,9	HV	100	40x
1,35	mm	20,52	19,56	461,9	HV	100	40x
1,35	mm	19,56	19,00	498,9	HV	100	40x
1,35	mm	19,14	19,00	509,8	HV	100	40x
1,35	mm	19,69	19,56	481,5	HV	100	40x
1,35	mm	21,48	22,03	391,7	HV	100	40x
1,35	mm	19,56	19,42	488,4	HV	100	40x
1,35	mm	19,56	19,28	491,8	HV	100	40x
1,35	mm	19,69	19,56	481,5	HV	100	40x
1,35	mm	19,42	19,14	498,9	HV	100	40x

Table 8.4: micro hardness measurements results with 100 N load from the surface of the plate for alloy718 SGA

Alloy 718 Small Grain Aged (center)

Depth		**D1 (µm)**	**D2 (µm)**	**Hardness**		**Load (gf)**	**Obj**
0,00	mm	20,24	20,52	446,4	HV	100	40x
0,00	mm	38,15	25,20	184,8	HV	100	40x
0,00	mm	19,83	19,56	478,2	HV	100	40x
0,00	mm	19,83	20,11	465,1	HV	100	40x
0,00	mm	19,56	19,69	481,5	HV	100	40x
0,00	mm	20,24	19,42	471,6	HV	100	40x
0,00	mm	19,97	19,97	465,1	HV	100	40x
0,00	mm	33,33	24,79	219,6	HV	100	40x
0,00	mm	19,83	19,28	484,9	HV	100	40x
0,00	mm	19,83	19,97	468,3	HV	100	40x
0,15	mm	19,97	20,52	452,5	HV	100	40x
0,15	mm	19,83	19,56	478,2	HV	100	40x
0,15	mm	19,42	19,83	481,5	HV	100	40x
0,15	mm	19,83	19,97	468,3	HV	100	40x
0,15	mm	19,97	19,83	468,3	HV	100	40x
0,15	mm	20,11	19,83	465,1	HV	100	40x

0,15	mm	19,97	19,28	481,5	HV	100	40x
0,15	mm	19,69	19,69	478,2	HV	100	40x
0,15	mm	19,97	20,11	461,9	HV	100	40x
0,15	mm	20,52	19,83	455,6	HV	100	40x
0,30	mm	19,97	19,56	474,9	HV	100	40x
0,30	mm	18,32	17,76	569,8	HV	100	40x
0,30	mm	19,97	19,97	465,1	HV	100	40x
0,30	mm	19,97	20,24	458,7	HV	100	40x
0,30	mm	20,24	19,83	461,9	HV	100	40x
0,30	mm	19,56	19,42	488,4	HV	100	40x
0,30	mm	20,24	19,69	465,1	HV	100	40x
0,30	mm	19,42	19,83	481,5	HV	100	40x
0,30	mm	19,83	19,97	468,3	HV	100	40x
0,30	mm	19,56	19,83	478,2	HV	100	40x
0,45	mm	19,28	19,42	495,3	HV	100	40x
0,45	mm	19,83	19,69	474,9	HV	100	40x
0,45	mm	19,69	19,97	471,6	HV	100	40x
0,45	mm	20,24	21,07	434,6	HV	100	40x
0,45	mm	19,83	19,97	468,3	HV	100	40x
0,45	mm	19,83	19,97	468,3	HV	100	40x
0,45	mm	19,69	20,11	468,3	HV	100	40x
0,45	mm	19,97	19,83	468,3	HV	100	40x
0,45	mm	19,97	20,11	461,9	HV	100	40x
0,45	mm	19,97	19,97	465,1	HV	100	40x
0,60	mm	19,83	19,42	481,5	HV	100	40x
0,60	mm	20,24	19,97	458,7	HV	100	40x
0,60	mm	19,97	19,83	468,3	HV	100	40x
0,60	mm	19,83	19,69	474,9	HV	100	40x
0,60	mm	19,97	19,56	474,9	HV	100	40x
0,60	mm	19,69	20,24	465,1	HV	100	40x
0,60	mm	19,28	20,38	471,6	HV	100	40x
0,60	mm	19,69	19,97	471,6	HV	100	40x
0,60	mm	19,69	19,69	478,2	HV	100	40x
0,60	mm	19,97	19,97	465,1	HV	100	40x
0,75	mm	19,56	19,42	488,4	HV	100	40x
0,75	mm	19,83	19,97	468,3	HV	100	40x
0,75	mm	19,97	19,83	468,3	HV	100	40x
0,75	mm	19,56	20,11	471,6	HV	100	40x
0,75	mm	19,42	19,42	491,8	HV	100	40x
0,75	mm	19,69	19,83	474,9	HV	100	40x
0,75	mm	19,42	19,83	481,5	HV	100	40x
0,75	mm	20,11	20,11	458,7	HV	100	40x
0,75	mm	19,97	19,83	468,3	HV	100	40x
0,75	mm	20,38	19,97	455,6	HV	100	40x
0,90	mm	20,11	19,97	461,9	HV	100	40x
0,90	mm	20,24	19,83	461,9	HV	100	40x
0,90	mm	19,69	19,83	474,9	HV	100	40x
0,90	mm	19,97	20,11	461,9	HV	100	40x
0,90	mm	20,11	19,83	465,1	HV	100	40x
0,90	mm	19,83	20,38	458,7	HV	100	40x
0,90	mm	20,11	19,97	461,9	HV	100	40x

0,90	mm	19,28	19,83	484,9	HV	100	40x
0,90	mm	19,83	20,52	455,6	HV	100	40x
0,90	mm	19,42	19,83	481,5	HV	100	40x
1,05	mm	19,97	19,97	465,1	HV	100	40x
1,05	mm	19,97	20,24	458,7	HV	100	40x
1,05	mm	19,69	19,56	481,5	HV	100	40x
1,05	mm	18,59	19,56	509,8	HV	100	40x
1,05	mm	20,11	20,66	446,4	HV	100	40x
1,05	mm	19,14	19,69	491,8	HV	100	40x
1,05	mm	18,87	19,97	491,8	HV	100	40x
1,05	mm	20,11	20,66	446,4	HV	100	40x
1,05	mm	19,97	20,11	461,9	HV	100	40x
1,05	mm	20,24	19,42	471,6	HV	100	40x
1,20	mm	19,83	19,83	471,6	HV	100	40x
1,20	mm	19,97	20,11	461,9	HV	100	40x
1,20	mm	20,24	20,24	452,5	HV	100	40x
1,20	mm	19,42	19,97	478,2	HV	100	40x
1,20	mm	19,83	21,07	443,4	HV	100	40x
1,20	mm	19,69	19,97	471,6	HV	100	40x
1,20	mm	20,24	19,83	461,9	HV	100	40x
1,20	mm	19,83	19,56	478,2	HV	100	40x
1,20	mm	20,24	19,97	458,7	HV	100	40x
1,20	mm	19,83	19,14	488,4	HV	100	40x
1,35	mm	20,11	19,56	471,6	HV	100	40x
1,35	mm	19,97	19,97	465,1	HV	100	40x
1,35	mm	18,73	19,83	498,9	HV	100	40x
1,35	mm	19,83	19,69	474,9	HV	100	40x
1,35	mm	20,24	20,11	455,6	HV	100	40x
1,35	mm	20,24	19,97	458,7	HV	100	40x
1,35	mm	20,24	19,69	465,1	HV	100	40x
1,35	mm	19,42	20,24	471,6	HV	100	40x
1,35	mm	19,97	20,24	458,7	HV	100	40x
1,35	mm	19,83	20,11	465,1	HV	100	40x

Table 8.46: micro hardness measurements results with 100 N load from the center of the plate for alloy718 SGA

Alloy 718 Large Grains Aged (surface)

Depth		**D1 (µm)**	**D2 (µm)**	**Hardness**		**Load (gf)**	**Obj**
0,00	mm	20,11	19,97	461,9	HV	100	40x
0,00	mm	20,66	19,69	455,6	HV	100	40x
0,00	mm	20,38	19,97	455,6	HV	100	40x
0,00	mm	19,97	19,42	478,2	HV	100	40x
0,00	mm	19,83	19,83	471,6	HV	100	40x
0,00	mm	19,97	20,52	452,5	HV	100	40x
0,00	mm	19,97	20,24	458,7	HV	100	40x
0,00	mm	20,11	20,79	443,4	HV	100	40x
0,00	mm	20,24	19,97	458,7	HV	100	40x
0,00	mm	19,97	19,56	474,9	HV	100	40x
0,15	mm	19,69	19,56	481,5	HV	100	40x

0,15	mm	19,97	19,83	468,3	HV	100	40x
0,15	mm	19,42	19,56	488,4	HV	100	40x
0,15	mm	20,24	19,97	458,7	HV	100	40x
0,15	mm	19,97	19,69	471,6	HV	100	40x
0,15	mm	20,52	20,24	446,4	HV	100	40x
0,15	mm	20,11	19,97	461,9	HV	100	40x
0,15	mm	20,11	19,83	465,1	HV	100	40x
0,15	mm	19,97	19,97	465,1	HV	100	40x
0,15	mm	20,38	19,83	458,7	HV	100	40x
0,30	mm	19,28	19,42	495,3	HV	100	40x
0,30	mm	19,69	19,69	478,2	HV	100	40x
0,30	mm	19,69	19,97	471,6	HV	100	40x
0,30	mm	19,83	19,14	488,4	HV	100	40x
0,30	mm	19,14	19,97	484,9	HV	100	40x
0,30	mm	19,56	19,14	495,3	HV	100	40x
0,30	mm	20,11	19,97	461,9	HV	100	40x
0,30	mm	19,56	19,56	484,9	HV	100	40x
0,30	mm	19,69	19,42	484,9	HV	100	40x
0,30	mm	19,42	19,56	488,4	HV	100	40x
0,45	mm	19,83	19,56	478,2	HV	100	40x
0,45	mm	19,69	19,83	474,9	HV	100	40x
0,45	mm	19,28	19,69	488,4	HV	100	40x
0,45	mm	19,56	19,69	481,5	HV	100	40x
0,45	mm	19,83	20,11	465,1	HV	100	40x
0,45	mm	19,42	19,42	491,8	HV	100	40x
0,45	mm	20,24	20,38	449,4	HV	100	40x
0,45	mm	19,42	19,83	481,5	HV	100	40x
0,45	mm	20,11	19,83	465,1	HV	100	40x
0,45	mm	19,69	19,69	478,2	HV	100	40x
0,60	mm	19,69	19,56	481,5	HV	100	40x
0,60	mm	19,42	19,69	484,9	HV	100	40x
0,60	mm	19,69	19,97	471,6	HV	100	40x
0,60	mm	20,11	20,52	449,4	HV	100	40x
0,60	mm	19,97	20,11	461,9	HV	100	40x
0,60	mm	19,56	19,69	481,5	HV	100	40x
0,60	mm	20,11	19,83	465,1	HV	100	40x
0,60	mm	19,14	19,42	498,9	HV	100	40x
0,60	mm	19,42	19,56	488,4	HV	100	40x
0,60	mm	19,69	19,83	474,9	HV	100	40x
0,75	mm	19,69	19,42	484,9	HV	100	40x
0,75	mm	19,69	19,56	481,5	HV	100	40x
0,75	mm	19,56	19,56	484,9	HV	100	40x
0,75	mm	19,56	19,42	488,4	HV	100	40x
0,75	mm	19,83	19,83	471,6	HV	100	40x
0,75	mm	19,28	19,56	491,8	HV	100	40x
0,75	mm	19,56	19,14	495,3	HV	100	40x
0,75	mm	19,00	19,28	506,1	HV	100	40x
0,75	mm	20,11	19,97	461,9	HV	100	40x
0,75	mm	19,42	19,83	481,5	HV	100	40x
0,90	mm	19,56	19,42	488,4	HV	100	40x
0,90	mm	20,11	19,69	468,3	HV	100	40x

0,90	mm	20,24	19,69	465,1	HV	100	40x
0,90	mm	20,11	19,42	474,9	HV	100	40x
0,90	mm	19,56	19,69	481,5	HV	100	40x
0,90	mm	19,83	19,83	471,6	HV	100	40x
0,90	mm	18,45	18,04	557,0	HV	100	40x
0,90	mm	20,38	19,56	465,1	HV	100	40x
0,90	mm	19,83	19,56	478,2	HV	100	40x
0,90	mm	19,56	19,56	484,9	HV	100	40x
1,05	mm	19,56	19,00	498,9	HV	100	40x
1,05	mm	19,97	19,69	471,6	HV	100	40x
1,05	mm	19,14	19,42	498,9	HV	100	40x
1,05	mm	19,42	19,69	484,9	HV	100	40x
1,05	mm	19,83	18,87	495,3	HV	100	40x
1,05	mm	19,56	19,28	491,8	HV	100	40x
1,05	mm	19,28	19,83	484,9	HV	100	40x
1,05	mm	19,56	20,11	471,6	HV	100	40x
1,05	mm	19,97	19,83	468,3	HV	100	40x
1,05	mm	19,56	19,56	484,9	HV	100	40x
1,20	mm	19,14	19,56	495,3	HV	100	40x
1,20	mm	19,28	19,69	488,4	HV	100	40x
1,20	mm	19,00	19,14	509,8	HV	100	40x
1,20	mm	19,14	19,28	502,5	HV	100	40x
1,20	mm	19,97	19,56	474,9	HV	100	40x
1,20	mm	19,83	19,69	474,9	HV	100	40x
1,20	mm	20,24	19,69	465,1	HV	100	40x
1,20	mm	20,11	20,24	455,6	HV	100	40x
1,20	mm	19,69	19,56	481,5	HV	100	40x
1,20	mm	19,97	19,69	471,6	HV	100	40x
1,35	mm	19,69	19,83	474,9	HV	100	40x
1,35	mm	19,56	19,42	488,4	HV	100	40x
1,35	mm	19,69	20,11	468,3	HV	100	40x
1,35	mm	19,28	19,69	488,4	HV	100	40x
1,35	mm	20,24	19,83	461,9	HV	100	40x
1,35	mm	19,56	19,42	488,4	HV	100	40x
1,35	mm	20,11	19,56	471,6	HV	100	40x
1,35	mm	20,24	19,83	461,9	HV	100	40x
1,35	mm	19,69	19,56	481,5	HV	100	40x
1,35	mm	19,69	19,42	484,9	HV	100	40x

Table 8.47: micro hardness measurements results with 100N load from the surface of the plate for alloy718 LGA

Alloy 718 Large Grains Aged (center)

Depth		**D1 (µm)**	**D2 (µm)**	**Hardness**		**Load (gf)**	**Obj**
0,00	mm	19,83	19,97	468,3	HV	100	40x
0,00	mm	20,24	19,42	471,6	HV	100	40x
0,00	mm	19,56	19,69	481,5	HV	100	40x
0,00	mm	19,97	19,14	484,9	HV	100	40x
0,00	mm	19,83	20,11	465,1	HV	100	40x
0,00	mm	19,69	19,42	484,9	HV	100	40x
0,00	mm	19,83	19,56	478,2	HV	100	40x

0,00	mm	19,97	19,69	471,6	HV	100	40x
0,00	mm	19,42	19,56	488,4	HV	100	40x
0,00	mm	20,11	19,69	468,3	HV	100	40x
0,15	mm	19,69	19,28	488,4	HV	100	40x
0,15	mm	19,83	19,28	484,9	HV	100	40x
0,15	mm	19,56	19,14	495,3	HV	100	40x
0,15	mm	19,69	19,56	481,5	HV	100	40x
0,15	mm	19,69	19,28	488,4	HV	100	40x
0,15	mm	19,42	19,69	484,9	HV	100	40x
0,15	mm	19,42	19,97	478,2	HV	100	40x
0,15	mm	19,28	19,42	495,3	HV	100	40x
0,15	mm	19,56	19,42	488,4	HV	100	40x
0,15	mm	20,11	20,24	455,6	HV	100	40x
0,30	mm	19,56	19,56	484,9	HV	100	40x
0,30	mm	19,28	19,56	491,8	HV	100	40x
0,30	mm	19,56	18,87	502,5	HV	100	40x
0,30	mm	19,56	19,28	491,8	HV	100	40x
0,30	mm	19,83	19,69	474,9	HV	100	40x
0,30	mm	19,42	19,28	495,3	HV	100	40x
0,30	mm	19,69	19,83	474,9	HV	100	40x
0,30	mm	19,56	19,42	488,4	HV	100	40x
0,30	mm	19,56	19,42	488,4	HV	100	40x
0,30	mm	20,11	19,69	468,3	HV	100	40x
0,45	mm	19,69	19,28	488,4	HV	100	40x
0,45	mm	19,00	19,00	513,5	HV	100	40x
0,45	mm	19,28	19,14	502,5	HV	100	40x
0,45	mm	19,42	19,56	488,4	HV	100	40x
0,45	mm	19,00	19,28	506,1	HV	100	40x
0,45	mm	19,42	19,97	478,2	HV	100	40x
0,45	mm	19,69	19,28	488,4	HV	100	40x
0,45	mm	24,24	26,58	287,3	HV	100	40x
0,45	mm	19,42	19,28	495,3	HV	100	40x
0,45	mm	19,83	19,97	468,3	HV	100	40x
0,60	mm	18,87	18,45	532,6	HV	100	40x
0,60	mm	19,56	19,28	491,8	HV	100	40x
0,60	mm	19,28	19,28	498,9	HV	100	40x
0,60	mm	19,69	19,42	484,9	HV	100	40x
0,60	mm	17,90	18,32	565,5	HV	100	40x
0,60	mm	19,00	19,69	495,3	HV	100	40x
0,60	mm	19,56	18,59	509,8	HV	100	40x
0,60	mm	19,56	18,73	506,1	HV	100	40x
0,60	mm	19,56	19,42	488,4	HV	100	40x
0,60	mm	19,28	19,14	502,5	HV	100	40x
0,75	mm	19,14	19,00	509,8	HV	100	40x
0,75	mm	19,69	19,28	488,4	HV	100	40x
0,75	mm	18,59	18,59	536,5	HV	100	40x
0,75	mm	19,00	18,87	517,2	HV	100	40x
0,75	mm	19,69	19,00	495,3	HV	100	40x
0,75	mm	19,69	19,69	478,2	HV	100	40x
0,75	mm	20,38	19,69	461,9	HV	100	40x
0,75	mm	19,28	19,69	488,4	HV	100	40x

0,75	mm	19,42	19,69	484,9	HV	100	40x
0,75	mm	19,28	19,69	488,4	HV	100	40x
0,90	mm	19,00	19,14	509,8	HV	100	40x
0,90	mm	19,14	19,28	502,5	HV	100	40x
0,90	mm	18,87	19,00	517,2	HV	100	40x
0,90	mm	19,00	18,87	517,2	HV	100	40x
0,90	mm	19,14	19,00	509,8	HV	100	40x
0,90	mm	19,28	19,69	488,4	HV	100	40x
0,90	mm	19,42	19,56	488,4	HV	100	40x
0,90	mm	19,83	19,42	481,5	HV	100	40x
0,90	mm	19,69	19,14	491,8	HV	100	40x
0,90	mm	19,69	19,69	478,2	HV	100	40x
1,05	mm	28,09	23,14	282,6	HV	100	40x
1,05	mm	19,83	19,56	478,2	HV	100	40x
1,05	mm	19,28	19,14	502,5	HV	100	40x
1,05	mm	20,11	19,28	478,2	HV	100	40x
1,05	mm	19,28	19,28	498,9	HV	100	40x
1,05	mm	19,56	19,42	488,4	HV	100	40x
1,05	mm	19,28	19,42	495,3	HV	100	40x
1,05	mm	19,97	19,28	481,5	HV	100	40x
1,05	mm	19,14	19,56	495,3	HV	100	40x
1,05	mm	19,42	19,97	478,2	HV	100	40x
1,20	mm	19,14	19,56	495,3	HV	100	40x
1,20	mm	19,14	19,00	509,8	HV	100	40x
1,20	mm	19,69	19,56	481,5	HV	100	40x
1,20	mm	19,56	19,14	495,3	HV	100	40x
1,20	mm	19,28	19,42	495,3	HV	100	40x
1,20	mm	19,42	19,56	488,4	HV	100	40x
1,20	mm	19,69	19,28	488,4	HV	100	40x
1,20	mm	19,56	19,56	484,9	HV	100	40x
1,20	mm	19,28	19,14	502,5	HV	100	40x
1,20	mm	19,83	19,56	478,2	HV	100	40x
1,35	mm	19,42	19,28	495,3	HV	100	40x
1,35	mm	18,73	19,00	521,0	HV	100	40x
1,35	mm	19,42	19,83	481,5	HV	100	40x
1,35	mm	18,73	18,73	528,7	HV	100	40x
1,35	mm	19,00	19,56	498,9	HV	100	40x
1,35	mm	19,69	19,69	478,2	HV	100	40x
1,35	mm	19,83	19,42	481,5	HV	100	40x
1,35	mm	19,97	19,42	478,2	HV	100	40x
1,35	mm	20,24	20,11	455,6	HV	100	40x
1,35	mm	19,69	19,83	474,9	HV	100	40x

Table 8.48: micro hardness measurements results with 100 N load from the center of the plate for alloy718 LGA

Alloy 718 Small Grain Solutioned (surface)

Depth		**D1 (µm)**	**D2 (µm)**	**Hardness**		**Load (gf)**	**Obj**
0,00	mm	27,82	27,82	239,6	HV	100	40x
0,00	mm	28,09	28,51	231,5	HV	100	40x
0,00	mm	28,51	29,06	223,9	HV	100	40x

0,00	mm	27,82	27,82	239,6	HV	100	40x
0,00	mm	28,09	26,85	245,7	HV	100	40x
0,00	mm	30,43	31,95	190,6	HV	100	40x
0,00	mm	28,78	28,23	228,2	HV	100	40x
0,00	mm	27,96	27,27	243,2	HV	100	40x
0,00	mm	29,33	29,33	215,5	HV	100	40x
0,00	mm	27,96	27,40	242,0	HV	100	40x
0,15	mm	27,96	26,72	248,2	HV	100	40x
0,15	mm	27,40	26,58	254,5	HV	100	40x
0,15	mm	27,40	27,13	249,4	HV	100	40x
0,15	mm	27,68	26,99	248,2	HV	100	40x
0,15	mm	27,13	26,99	253,2	HV	100	40x
0,15	mm	28,92	28,64	223,9	HV	100	40x
0,15	mm	28,09	27,13	243,2	HV	100	40x
0,15	mm	27,54	26,99	249,4	HV	100	40x
0,15	mm	28,51	28,09	231,5	HV	100	40x
0,15	mm	27,68	27,54	243,2	HV	100	40x
0,30	mm	27,96	26,72	248,2	HV	100	40x
0,30	mm	27,40	27,68	244,5	HV	100	40x
0,30	mm	27,13	27,27	250,7	HV	100	40x
0,30	mm	27,27	26,72	254,5	HV	100	40x
0,30	mm	28,23	26,99	243,2	HV	100	40x
0,30	mm	27,96	27,82	238,5	HV	100	40x
0,30	mm	27,96	26,44	250,7	HV	100	40x
0,30	mm	28,37	27,96	233,8	HV	100	40x
0,30	mm	28,09	26,99	244,5	HV	100	40x
0,30	mm	28,09	28,09	235,0	HV	100	40x
0,45	mm	31,54	30,43	193,2	HV	100	40x
0,45	mm	28,78	28,09	229,3	HV	100	40x
0,45	mm	28,09	27,68	238,5	HV	100	40x
0,45	mm	27,54	27,27	246,9	HV	100	40x
0,45	mm	28,92	27,96	229,3	HV	100	40x
0,45	mm	27,27	26,99	252,0	HV	100	40x
0,45	mm	29,19	28,78	220,7	HV	100	40x
0,45	mm	26,99	26,44	259,8	HV	100	40x
0,45	mm	28,51	28,09	231,5	HV	100	40x
0,45	mm	28,09	28,51	231,5	HV	100	40x
0,60	mm	27,54	27,68	243,2	HV	100	40x
0,60	mm	27,13	26,85	254,5	HV	100	40x
0,60	mm	27,54	28,23	238,5	HV	100	40x
0,60	mm	26,99	25,75	266,6	HV	100	40x
0,60	mm	27,13	27,54	248,2	HV	100	40x
0,60	mm	27,27	27,54	246,9	HV	100	40x
0,60	mm	27,27	26,17	259,8	HV	100	40x
0,60	mm	28,09	27,40	240,8	HV	100	40x
0,60	mm	26,85	27,68	249,4	HV	100	40x
0,60	mm	27,96	27,40	242,0	HV	100	40x
0,75	mm	27,96	27,13	244,5	HV	100	40x
0,75	mm	27,40	26,99	250,7	HV	100	40x
0,75	mm	27,96	27,82	238,5	HV	100	40x
0,75	mm	27,40	27,27	248,2	HV	100	40x

0,75	mm	28,37	26,30	248,2	HV	100	40x
0,75	mm	27,27	26,99	252,0	HV	100	40x
0,75	mm	28,23	27,82	236,1	HV	100	40x
0,75	mm	27,54	27,40	245,7	HV	100	40x
0,75	mm	28,23	28,64	229,3	HV	100	40x
0,75	mm	27,54	26,44	254,5	HV	100	40x
0,90	mm	27,82	27,54	242,0	HV	100	40x
0,90	mm	27,13	26,72	255,8	HV	100	40x
0,90	mm	26,72	26,44	262,5	HV	100	40x
0,90	mm	29,06	27,68	230,4	HV	100	40x
0,90	mm	28,37	27,54	237,3	HV	100	40x
0,90	mm	27,13	26,85	254,5	HV	100	40x
0,90	mm	26,99	26,99	254,5	HV	100	40x
0,90	mm	28,64	26,72	242,0	HV	100	40x
0,90	mm	27,82	27,27	244,5	HV	100	40x
0,90	mm	27,54	27,82	242,0	HV	100	40x
1,05	mm	26,58	26,72	261,2	HV	100	40x
1,05	mm	27,40	27,68	244,5	HV	100	40x
1,05	mm	28,23	26,85	244,5	HV	100	40x
1,05	mm	27,96	28,09	236,1	HV	100	40x
1,05	mm	28,23	26,58	246,9	HV	100	40x
1,05	mm	26,85	27,54	250,7	HV	100	40x
1,05	mm	24,51	26,58	284,2	HV	100	40x
1,05	mm	26,85	25,48	270,9	HV	100	40x
1,05	mm	25,34	25,89	282,6	HV	100	40x
1,05	mm	28,09	26,72	246,9	HV	100	40x
1,20	mm	28,37	27,96	233,8	HV	100	40x
1,20	mm	28,92	28,09	228,2	HV	100	40x
1,20	mm	27,96	28,64	231,5	HV	100	40x
1,20	mm	28,64	27,54	235,0	HV	100	40x
1,20	mm	28,09	27,82	237,3	HV	100	40x
1,20	mm	27,82	27,40	243,2	HV	100	40x
1,20	mm	27,82	28,09	237,3	HV	100	40x
1,20	mm	26,44	26,03	269,4	HV	100	40x
1,20	mm	26,58	27,40	254,5	HV	100	40x
1,20	mm	27,82	27,54	242,0	HV	100	40x
1,35	mm	28,09	27,40	240,8	HV	100	40x
1,35	mm	26,99	26,99	254,5	HV	100	40x
1,35	mm	28,23	27,68	237,3	HV	100	40x
1,35	mm	27,13	26,85	254,5	HV	100	40x
1,35	mm	33,33	33,60	165,6	HV	100	40x
1,35	mm	27,13	28,09	243,2	HV	100	40x
1,35	mm	28,64	28,37	228,2	HV	100	40x
1,35	mm	26,85	26,72	258,5	HV	100	40x
1,35	mm	28,23	26,72	245,7	HV	100	40x
1,35	mm	25,75	24,51	293,6	HV	100	40x

Table 8.49: micro hardness measurements results with 100 N load from the surface of the plate for alloy718 SGS

Alloy 718 Small Grain Solutioned (center)

Depth		D1 (µm)	D2 (µm)	Hardness		Load (gf)	Obj
0,00	mm	25,48	25,20	288,8	HV	100	40x
0,00	mm	26,58	25,89	269,4	HV	100	40x
0,00	mm	25,75	25,89	278,1	HV	100	40x
0,00	mm	25,89	25,75	278,1	HV	100	40x
0,00	mm	26,17	25,89	273,7	HV	100	40x
0,00	mm	26,17	25,61	276,7	HV	100	40x
0,00	mm	26,03	26,03	273,7	HV	100	40x
0,00	mm	25,75	25,06	287,3	HV	100	40x
0,00	mm	25,61	25,89	279,6	HV	100	40x
0,00	mm	25,89	25,61	279,6	HV	100	40x
0,15	mm	26,17	26,58	266,6	HV	100	40x
0,15	mm	26,44	26,17	268,0	HV	100	40x
0,15	mm	25,06	25,61	288,8	HV	100	40x
0,15	mm	26,17	25,61	276,7	HV	100	40x
0,15	mm	25,20	25,61	287,3	HV	100	40x
0,15	mm	26,03	25,34	281,1	HV	100	40x
0,15	mm	26,30	25,75	273,7	HV	100	40x
0,15	mm	26,03	26,17	272,3	HV	100	40x
0,15	mm	25,48	25,34	287,3	HV	100	40x
0,15	mm	22,45	24,10	342,4	HV	100	40x
0,30	mm	25,61	25,89	279,6	HV	100	40x
0,30	mm	26,30	25,20	279,6	HV	100	40x
0,30	mm	25,61	25,20	287,3	HV	100	40x
0,30	mm	25,75	25,89	278,1	HV	100	40x
0,30	mm	26,30	26,03	270,9	HV	100	40x
0,30	mm	26,03	25,48	279,6	HV	100	40x
0,30	mm	25,75	25,75	279,6	HV	100	40x
0,30	mm	25,34	24,65	296,8	HV	100	40x
0,30	mm	25,75	26,30	273,7	HV	100	40x
0,30	mm	26,30	26,03	270,9	HV	100	40x
0,45	mm	25,20	26,03	282,6	HV	100	40x
0,45	mm	25,34	25,89	282,6	HV	100	40x
0,45	mm	26,17	25,34	279,6	HV	100	40x
0,45	mm	26,03	26,17	272,3	HV	100	40x
0,45	mm	26,17	26,44	268,0	HV	100	40x
0,45	mm	25,89	26,17	273,7	HV	100	40x
0,45	mm	25,61	25,89	279,6	HV	100	40x
0,45	mm	25,48	26,72	272,3	HV	100	40x
0,45	mm	25,06	25,20	293,6	HV	100	40x
0,45	mm	25,61	25,06	288,8	HV	100	40x
0,60	mm	25,89	26,44	270,9	HV	100	40x
0,60	mm	24,93	24,51	303,5	HV	100	40x
0,60	mm	25,89	26,58	269,4	HV	100	40x
0,60	mm	24,93	24,65	301,8	HV	100	40x
0,60	mm	25,75	25,75	279,6	HV	100	40x
0,60	mm	26,17	25,89	273,7	HV	100	40x
0,60	mm	26,44	26,17	268,0	HV	100	40x
0,60	mm	25,75	26,03	276,7	HV	100	40x

0,60	mm	26,44	25,20	278,1	HV	100	40x
0,60	mm	25,61	26,03	278,1	HV	100	40x
0,75	mm	25,48	25,61	284,2	HV	100	40x
0,75	mm	25,75	25,89	278,1	HV	100	40x
0,75	mm	26,17	25,89	273,7	HV	100	40x
0,75	mm	24,37	23,96	317,5	HV	100	40x
0,75	mm	25,48	25,89	281,1	HV	100	40x
0,75	mm	26,30	25,48	276,7	HV	100	40x
0,75	mm	25,75	26,03	276,7	HV	100	40x
0,75	mm	25,89	26,03	275,2	HV	100	40x
0,75	mm	26,99	26,03	263,9	HV	100	40x
0,75	mm	26,58	26,17	266,6	HV	100	40x
0,90	mm	26,30	26,30	268,0	HV	100	40x
0,90	mm	25,75	25,06	287,3	HV	100	40x
0,90	mm	25,06	25,61	288,8	HV	100	40x
0,90	mm	25,06	25,34	292,0	HV	100	40x
0,90	mm	25,89	26,03	275,2	HV	100	40x
0,90	mm	26,99	26,44	259,8	HV	100	40x
0,90	mm	26,30	26,03	270,9	HV	100	40x
0,90	mm	27,13	25,06	272,3	HV	100	40x
0,90	mm	26,03	26,03	273,7	HV	100	40x
0,90	mm	26,03	26,03	273,7	HV	100	40x
1,05	mm	26,03	25,20	282,6	HV	100	40x
1,05	mm	26,30	26,58	265,3	HV	100	40x
1,05	mm	25,89	25,61	279,6	HV	100	40x
1,05	mm	25,89	25,75	278,1	HV	100	40x
1,05	mm	26,58	25,89	269,4	HV	100	40x
1,05	mm	26,03	26,17	272,3	HV	100	40x
1,05	mm	25,48	25,75	282,6	HV	100	40x
1,05	mm	26,03	25,61	278,1	HV	100	40x
1,05	mm	26,72	26,30	263,9	HV	100	40x
1,05	mm	26,30	25,48	276,7	HV	100	40x
1,20	mm	25,89	25,75	278,1	HV	100	40x
1,20	mm	25,34	24,93	293,6	HV	100	40x
1,20	mm	24,51	24,79	305,2	HV	100	40x
1,20	mm	25,75	26,03	276,7	HV	100	40x
1,20	mm	25,34	26,44	276,7	HV	100	40x
1,20	mm	26,44	26,72	262,5	HV	100	40x
1,20	mm	26,03	25,89	275,2	HV	100	40x
1,20	mm	26,03	25,48	279,6	HV	100	40x
1,20	mm	25,61	25,06	288,8	HV	100	40x
1,20	mm	25,75	25,48	282,6	HV	100	40x
1,35	mm	25,34	25,75	284,2	HV	100	40x
1,35	mm	25,61	25,89	279,6	HV	100	40x
1,35	mm	25,48	25,89	281,1	HV	100	40x
1,35	mm	26,85	26,30	262,5	HV	100	40x
1,35	mm	25,20	25,89	284,2	HV	100	40x
1,35	mm	26,03	26,17	272,3	HV	100	40x
1,35	mm	26,44	26,17	268,0	HV	100	40x
1,35	mm	26,03	25,61	278,1	HV	100	40x
1,35	mm	25,75	25,75	279,6	HV	100	40x

1,35	mm	25,89	25,06	285,7	HV	100	40x

Table 8.50: micro hardness measurements results with 100 N load from the center of the plate for alloy718 SGS

SS 2303 (surface)

Depth		**D1 (µm)**	**D2 (µm)**	**Hardness**		**Load (gf)**	**Obj**
0,00	mm	34,15	33,88	160,3	HV	100	40x
0,00	mm	33,74	34,43	159,6	HV	100	40x
0,00	mm	35,67	34,29	151,6	HV	100	40x
0,00	mm	36,22	35,67	143,5	HV	100	40x
0,00	mm	35,53	35,67	146,3	HV	100	40x
0,00	mm	35,12	34,98	151,0	HV	100	40x
0,00	mm	35,39	33,74	155,2	HV	100	40x
0,00	mm	36,08	35,39	145,2	HV	100	40x
0,00	mm	33,60	33,19	166,3	HV	100	40x
0,00	mm	34,70	34,01	157,1	HV	100	40x
0,15	mm	34,70	35,39	151,0	HV	100	40x
0,15	mm	35,53	35,53	146,9	HV	100	40x
0,15	mm	35,53	35,94	145,2	HV	100	40x
0,15	mm	34,84	35,39	150,4	HV	100	40x
0,15	mm	33,74	33,60	163,6	HV	100	40x
0,15	mm	34,01	34,84	156,5	HV	100	40x
0,15	mm	34,43	37,04	145,2	HV	100	40x
0,15	mm	33,46	32,36	171,2	HV	100	40x
0,15	mm	33,60	33,19	166,3	HV	100	40x
0,15	mm	34,01	34,70	157,1	HV	100	40x
0,30	mm	34,43	34,70	155,2	HV	100	40x
0,30	mm	35,81	35,12	147,5	HV	100	40x
0,30	mm	32,91	33,19	169,8	HV	100	40x
0,30	mm	35,81	35,53	145,8	HV	100	40x
0,30	mm	34,84	35,39	150,4	HV	100	40x
0,30	mm	36,22	35,12	145,8	HV	100	40x
0,30	mm	34,15	34,84	155,8	HV	100	40x
0,30	mm	34,15	35,12	154,6	HV	100	40x
0,30	mm	34,98	34,29	154,6	HV	100	40x
0,30	mm	35,12	36,08	146,3	HV	100	40x
0,45	mm	34,84	34,01	156,5	HV	100	40x
0,45	mm	34,57	34,57	155,2	HV	100	40x
0,45	mm	33,19	33,74	165,6	HV	100	40x
0,45	mm	33,19	33,60	166,3	HV	100	40x
0,45	mm	34,01	34,70	157,1	HV	100	40x
0,45	mm	34,15	34,43	157,7	HV	100	40x
0,45	mm	34,84	33,74	157,7	HV	100	40x
0,45	mm	35,12	35,39	149,2	HV	100	40x
0,45	mm	35,12	35,25	149,8	HV	100	40x
0,45	mm	34,70	35,67	149,8	HV	100	40x
0,60	mm	34,84	34,29	155,2	HV	100	40x
0,60	mm	34,29	35,12	154,0	HV	100	40x
0,60	mm	34,98	35,39	149,8	HV	100	40x
0,60	mm	33,60	34,15	161,6	HV	100	40x

0,60	mm	35,12	34,57	152,8	HV	100	40x
0,60	mm	33,46	34,84	159,0	HV	100	40x
0,60	mm	34,43	35,12	153,4	HV	100	40x
0,60	mm	33,19	33,74	165,6	HV	100	40x
0,60	mm	34,70	35,39	151,0	HV	100	40x
0,60	mm	34,29	33,74	160,3	HV	100	40x
0,75	mm	34,01	35,25	154,6	HV	100	40x
0,75	mm	34,15	33,74	160,9	HV	100	40x
0,75	mm	36,08	36,36	141,4	HV	100	40x
0,75	mm	35,67	34,98	148,6	HV	100	40x
0,75	mm	34,01	33,74	161,6	HV	100	40x
0,75	mm	35,53	35,39	147,5	HV	100	40x
0,75	mm	35,94	34,15	151,0	HV	100	40x
0,75	mm	33,33	33,05	168,4	HV	100	40x
0,75	mm	35,12	35,53	148,6	HV	100	40x
0,75	mm	34,98	34,84	152,2	HV	100	40x
0,90	mm	34,01	33,74	161,6	HV	100	40x
0,90	mm	35,81	35,39	146,3	HV	100	40x
0,90	mm	35,12	35,81	147,5	HV	100	40x
0,90	mm	35,25	35,39	148,6	HV	100	40x
0,90	mm	34,70	34,98	152,8	HV	100	40x
0,90	mm	34,84	35,12	151,6	HV	100	40x
0,90	mm	33,88	34,15	160,3	HV	100	40x
0,90	mm	34,15	34,29	158,3	HV	100	40x
0,90	mm	34,01	34,43	158,3	HV	100	40x
0,90	mm	35,12	35,12	150,4	HV	100	40x
1,05	mm	33,60	34,43	160,3	HV	100	40x
1,05	mm	35,94	34,29	150,4	HV	100	40x
1,05	mm	34,98	35,81	148,0	HV	100	40x
1,05	mm	33,74	35,67	154,0	HV	100	40x
1,05	mm	34,43	34,43	156,5	HV	100	40x
1,05	mm	33,88	32,91	166,3	HV	100	40x
1,05	mm	34,29	35,12	154,0	HV	100	40x
1,05	mm	34,01	34,57	157,7	HV	100	40x
1,05	mm	35,67	34,57	150,4	HV	100	40x
1,05	mm	35,25	34,57	152,2	HV	100	40x
1,20	mm	33,88	33,33	164,2	HV	100	40x
1,20	mm	34,29	34,57	156,5	HV	100	40x
1,20	mm	32,91	34,01	165,6	HV	100	40x
1,20	mm	35,67	35,67	145,8	HV	100	40x
1,20	mm	34,70	34,01	157,1	HV	100	40x
1,20	mm	33,19	33,46	167,0	HV	100	40x
1,20	mm	33,33	33,46	166,3	HV	100	40x
1,20	mm	34,43	35,12	153,4	HV	100	40x
1,20	mm	34,43	33,46	160,9	HV	100	40x
1,20	mm	34,70	34,29	155,8	HV	100	40x
1,35	mm	33,33	33,60	165,6	HV	100	40x
1,35	mm	33,88	33,60	162,9	HV	100	40x
1,35	mm	34,84	35,81	148,6	HV	100	40x
1,35	mm	33,88	33,60	162,9	HV	100	40x
1,35	mm	33,60	33,60	164,2	HV	100	40x

1,35	mm	33,46	34,15	162,2	HV	100	40x
1,35	mm	33,19	33,74	165,6	HV	100	40x
1,35	mm	34,98	33,46	158,3	HV	100	40x
1,35	mm	33,46	33,33	166,3	HV	100	40x
1,35	mm	33,33	33,19	167,7	HV	100	40x

Table 8.51: micro hardness measurements results with 100 N load from the surface of the plate for SS2303

SS 2303 (center)

Depth		**D1 (µm)**	**D2 (µm)**	**Hardness**		**Load (gf)**	**Obj**
0,00	mm	34,29	33,33	162,2	HV	100	Diamond
0,00	mm	34,57	34,01	157,7	HV	100	Diamond
0,00	mm	34,43	35,12	153,4	HV	100	Diamond
0,00	mm	35,53	34,43	151,6	HV	100	Diamond
0,00	mm	34,43	33,74	159,6	HV	100	Diamond
0,00	mm	35,81	35,12	147,5	HV	100	Diamond
0,00	mm	35,39	35,53	147,5	HV	100	Diamond
0,00	mm	35,53	35,25	148,0	HV	100	Diamond
0,00	mm	33,74	32,91	167,0	HV	100	Diamond
0,00	mm	35,81	36,77	140,8	HV	100	Diamond
0,15	mm	34,98	34,98	151,6	HV	100	40x
0,15	mm	34,98	34,84	152,2	HV	100	40x
0,15	mm	32,36	32,09	178,6	HV	100	40x
0,15	mm	35,67	34,84	149,2	HV	100	40x
0,15	mm	33,19	33,60	166,3	HV	100	40x
0,15	mm	34,70	34,43	155,2	HV	100	40x
0,15	mm	34,98	34,15	155,2	HV	100	40x
0,15	mm	34,01	34,98	155,8	HV	100	40x
0,15	mm	33,74	33,05	166,3	HV	100	40x
0,15	mm	35,39	34,57	151,6	HV	100	40x
0,30	mm	34,43	35,12	153,4	HV	100	40x
0,30	mm	34,43	33,74	159,6	HV	100	40x
0,30	mm	34,70	34,29	155,8	HV	100	40x
0,30	mm	33,74	33,46	164,2	HV	100	40x
0,30	mm	35,67	35,39	146,9	HV	100	40x
0,30	mm	33,74	34,70	158,3	HV	100	40x
0,30	mm	35,25	34,84	151,0	HV	100	40x
0,30	mm	33,88	34,70	157,7	HV	100	40x
0,30	mm	35,53	34,98	149,2	HV	100	40x
0,30	mm	33,74	32,78	167,7	HV	100	40x
0,45	mm	34,84	33,74	157,7	HV	100	40x
0,45	mm	35,12	35,25	149,8	HV	100	40x
0,45	mm	33,88	33,19	164,9	HV	100	40x
0,45	mm	34,70	33,88	157,7	HV	100	40x
0,45	mm	34,98	35,25	150,4	HV	100	40x
0,45	mm	34,43	35,12	153,4	HV	100	40x
0,45	mm	34,15	35,12	154,6	HV	100	40x
0,45	mm	34,57	34,43	155,8	HV	100	40x
0,45	mm	34,84	34,57	154,0	HV	100	40x
0,45	mm	34,29	34,98	154,6	HV	100	40x

0,60	mm	33,88	35,12	155,8	HV	100	40x
0,60	mm	35,25	34,29	153,4	HV	100	40x
0,60	mm	33,19	33,60	166,3	HV	100	40x
0,60	mm	34,29	33,74	160,3	HV	100	40x
0,60	mm	35,25	34,29	153,4	HV	100	40x
0,60	mm	35,81	35,12	147,5	HV	100	40x
0,60	mm	35,25	34,84	151,0	HV	100	40x
0,60	mm	33,46	34,57	160,3	HV	100	40x
0,60	mm	35,53	35,39	147,5	HV	100	40x
0,60	mm	33,74	34,43	159,6	HV	100	40x
0,75	mm	32,91	34,29	164,2	HV	100	40x
0,75	mm	33,19	33,74	165,6	HV	100	40x
0,75	mm	34,43	33,46	160,9	HV	100	40x
0,75	mm	33,60	33,05	167,0	HV	100	40x
0,75	mm	34,01	33,19	164,2	HV	100	40x
0,75	mm	33,74	33,33	164,9	HV	100	40x
0,75	mm	34,57	33,74	159,0	HV	100	40x
0,75	mm	33,88	33,33	164,2	HV	100	40x
0,75	mm	35,25	35,53	148,0	HV	100	40x
0,75	mm	34,84	36,08	147,5	HV	100	40x
0,90	mm	34,43	34,84	154,6	HV	100	40x
0,90	mm	33,74	33,74	162,9	HV	100	40x
0,90	mm	32,78	32,64	173,4	HV	100	40x
0,90	mm	33,46	35,25	157,1	HV	100	40x
0,90	mm	34,57	34,29	156,5	HV	100	40x
0,90	mm	34,70	33,74	158,3	HV	100	40x
0,90	mm	34,43	33,88	159,0	HV	100	40x
0,90	mm	34,15	34,98	155,2	HV	100	40x
0,90	mm	36,08	36,08	142,4	HV	100	40x
0,90	mm	34,43	34,43	156,5	HV	100	40x
1,05	mm	33,05	32,64	171,9	HV	100	40x
1,05	mm	33,46	34,01	162,9	HV	100	40x
1,05	mm	33,74	34,57	159,0	HV	100	40x
1,05	mm	33,33	34,98	159,0	HV	100	40x
1,05	mm	34,84	35,25	151,0	HV	100	40x
1,05	mm	35,39	34,01	154,0	HV	100	40x
1,05	mm	34,84	34,29	155,2	HV	100	40x
1,05	mm	34,29	34,98	154,6	HV	100	40x
1,05	mm	36,08	34,98	146,9	HV	100	40x
1,05	mm	34,84	34,70	153,4	HV	100	40x
1,20	mm	35,53	34,84	149,8	HV	100	40x
1,20	mm	34,43	34,70	155,2	HV	100	40x
1,20	mm	35,39	35,67	146,9	HV	100	40x
1,20	mm	37,18	36,22	137,7	HV	100	40x
1,20	mm	34,57	32,50	164,9	HV	100	40x
1,20	mm	35,53	35,12	148,6	HV	100	40x
1,20	mm	36,77	34,84	144,6	HV	100	40x
1,20	mm	34,98	35,39	149,8	HV	100	40x
1,20	mm	35,67	35,67	145,8	HV	100	40x
1,20	mm	34,57	34,98	153,4	HV	100	40x
1,35	mm	34,84	34,15	155,8	HV	100	40x

1,35	mm	35,39	33,88	154,6	HV	100	40x
1,35	mm	35,12	35,12	150,4	HV	100	40x
1,35	mm	33,46	32,91	168,4	HV	100	40x
1,35	mm	34,29	35,39	152,8	HV	100	40x
1,35	mm	33,88	34,29	159,6	HV	100	40x
1,35	mm	35,53	34,15	152,8	HV	100	40x
1,35	mm	34,57	35,67	150,4	HV	100	40x
1,35	mm	34,98	34,70	152,8	HV	100	40x
1,35	mm	35,67	34,57	150,4	HV	100	40x

Table 8.52: micro hardness measurements results with 100 N load from the center of the plate for SS2303

SS 1672 (surface)

Depth		**D1 (µm)**	**D2 (µm)**	**Hardness**		**Load (gf)**	**Obj**
0,00	mm	28,09	28,37	232,7	HV	100	40x
0,00	mm	28,51	27,68	235,0	HV	100	40x
0,00	mm	27,27	27,54	246,9	HV	100	40x
0,00	mm	28,09	27,40	240,8	HV	100	40x
0,00	mm	27,82	28,09	237,3	HV	100	40x
0,00	mm	27,96	27,68	239,6	HV	100	40x
0,00	mm	28,23	27,13	242,0	HV	100	40x
0,00	mm	27,96	27,54	240,8	HV	100	40x
0,00	mm	28,23	27,68	237,3	HV	100	40x
0,00	mm	27,68	27,54	243,2	HV	100	40x
0,15	mm	26,99	27,82	246,9	HV	100	40x
0,15	mm	27,96	27,40	242,0	HV	100	40x
0,15	mm	27,82	27,13	245,7	HV	100	40x
0,15	mm	28,23	27,68	237,3	HV	100	40x
0,15	mm	27,40	27,68	244,5	HV	100	40x
0,15	mm	26,99	26,99	254,5	HV	100	40x
0,15	mm	27,96	27,27	243,2	HV	100	40x
0,15	mm	27,54	28,23	238,5	HV	100	40x
0,15	mm	27,54	26,99	249,4	HV	100	40x
0,15	mm	28,78	27,68	232,7	HV	100	40x
0,30	mm	28,09	27,68	238,5	HV	100	40x
0,30	mm	26,99	27,13	253,2	HV	100	40x
0,30	mm	27,54	28,09	239,6	HV	100	40x
0,30	mm	27,82	26,99	246,9	HV	100	40x
0,30	mm	27,40	27,68	244,5	HV	100	40x
0,30	mm	28,37	27,82	235,0	HV	100	40x
0,30	mm	28,09	27,54	239,6	HV	100	40x
0,30	mm	27,54	27,96	240,8	HV	100	40x
0,30	mm	28,09	27,82	237,3	HV	100	40x
0,30	mm	27,82	27,96	238,5	HV	100	40x
0,45	mm	26,44	27,40	255,8	HV	100	40x
0,45	mm	28,09	28,09	235,0	HV	100	40x
0,45	mm	27,27	27,68	245,7	HV	100	40x
0,45	mm	27,68	27,54	243,2	HV	100	40x
0,45	mm	27,40	27,40	246,9	HV	100	40x
0,45	mm	27,82	27,54	242,0	HV	100	40x

0,45	mm	28,51	28,78	226,0	HV	100	40x
0,45	mm	27,40	26,99	250,7	HV	100	40x
0,45	mm	30,57	30,43	199,3	HV	100	40x
0,45	mm	27,96	27,68	239,6	HV	100	40x
0,60	mm	27,68	27,40	244,5	HV	100	40x
0,60	mm	28,09	27,82	237,3	HV	100	40x
0,60	mm	27,82	27,96	238,5	HV	100	40x
0,60	mm	27,54	27,27	246,9	HV	100	40x
0,60	mm	27,68	27,82	240,8	HV	100	40x
0,60	mm	27,40	27,82	243,2	HV	100	40x
0,60	mm	27,82	27,54	242,0	HV	100	40x
0,60	mm	27,82	27,82	239,6	HV	100	40x
0,60	mm	26,85	27,54	250,7	HV	100	40x
0,60	mm	27,68	27,40	244,5	HV	100	40x
0,75	mm	27,68	27,68	242,0	HV	100	40x
0,75	mm	27,68	27,13	246,9	HV	100	40x
0,75	mm	27,40	27,96	242,0	HV	100	40x
0,75	mm	27,40	27,68	244,5	HV	100	40x
0,75	mm	26,99	27,13	253,2	HV	100	40x
0,75	mm	27,40	27,40	246,9	HV	100	40x
0,75	mm	27,27	28,51	238,5	HV	100	40x
0,75	mm	27,27	27,68	245,7	HV	100	40x
0,75	mm	27,82	27,68	240,8	HV	100	40x
0,75	mm	26,58	26,99	258,5	HV	100	40x
0,90	mm	27,27	27,68	245,7	HV	100	40x
0,90	mm	27,54	27,40	245,7	HV	100	40x
0,90	mm	27,40	28,09	240,8	HV	100	40x
0,90	mm	27,54	27,27	246,9	HV	100	40x
0,90	mm	28,51	28,23	230,4	HV	100	40x
0,90	mm	27,27	27,40	248,2	HV	100	40x
0,90	mm	27,96	27,82	238,5	HV	100	40x
0,90	mm	27,40	27,82	243,2	HV	100	40x
0,90	mm	27,54	27,27	246,9	HV	100	40x
0,90	mm	27,27	27,27	249,4	HV	100	40x
1,05	mm	27,27	27,13	250,7	HV	100	40x
1,05	mm	28,09	27,96	236,1	HV	100	40x
1,05	mm	27,68	27,54	243,2	HV	100	40x
1,05	mm	27,54	26,58	253,2	HV	100	40x
1,05	mm	27,40	27,13	249,4	HV	100	40x
1,05	mm	27,40	27,13	249,4	HV	100	40x
1,05	mm	28,09	27,96	236,1	HV	100	40x
1,05	mm	27,82	27,54	242,0	HV	100	40x
1,05	mm	27,68	26,85	249,4	HV	100	40x
1,05	mm	27,54	27,54	244,5	HV	100	40x
1,20	mm	28,09	27,68	238,5	HV	100	40x
1,20	mm	27,40	27,13	249,4	HV	100	40x
1,20	mm	28,09	27,82	237,3	HV	100	40x
1,20	mm	28,09	27,54	239,6	HV	100	40x
1,20	mm	27,40	27,54	245,7	HV	100	40x
1,20	mm	27,68	27,27	245,7	HV	100	40x
1,20	mm	28,23	27,40	239,6	HV	100	40x

1,20	mm	27,96	27,54	240,8	HV	100	40x
1,20	mm	27,40	27,40	246,9	HV	100	40x
1,20	mm	27,96	28,23	235,0	HV	100	40x
1,35	mm	28,23	27,13	242,0	HV	100	40x
1,35	mm	27,40	26,99	250,7	HV	100	40x
1,35	mm	27,68	27,68	242,0	HV	100	40x
1,35	mm	27,96	27,68	239,6	HV	100	40x
1,35	mm	28,37	27,40	238,5	HV	100	40x
1,35	mm	28,37	27,40	238,5	HV	100	40x
1,35	mm	28,09	27,82	237,3	HV	100	40x
1,35	mm	28,92	28,09	228,2	HV	100	40x
1,35	mm	28,23	27,68	237,3	HV	100	40x
1,35	mm	28,23	28,09	233,8	HV	100	40x

Table 8.53: micro hardness measurements results with 100 N load from the surface of the plate for SS1672

SS 1672 (center)

Depth		**D1 (µm)**	**D2 (µm)**	**Hardness**		**Load (gf)**	**Obj**
0,00	mm	26,72	27,27	254,5	HV	100	40x
0,00	mm	28,78	28,23	228,2	HV	100	40x
0,00	mm	27,54	28,09	239,6	HV	100	40x
0,00	mm	27,68	27,68	242,0	HV	100	40x
0,00	mm	27,68	27,68	242,0	HV	100	40x
0,00	mm	28,37	26,99	242,0	HV	100	40x
0,00	mm	26,99	26,85	255,8	HV	100	40x
0,00	mm	27,82	27,40	243,2	HV	100	40x
0,00	mm	28,23	28,09	233,8	HV	100	40x
0,00	mm	29,33	29,47	214,5	HV	100	40x
0,15	mm	29,19	28,23	224,9	HV	100	40x
0,15	mm	26,85	26,44	261,2	HV	100	40x
0,15	mm	27,68	27,96	239,6	HV	100	40x
0,15	mm	26,99	27,68	248,2	HV	100	40x
0,15	mm	28,09	27,82	237,3	HV	100	40x
0,15	mm	28,92	28,64	223,9	HV	100	40x
0,15	mm	27,40	27,96	242,0	HV	100	40x
0,15	mm	27,82	27,82	239,6	HV	100	40x
0,15	mm	27,27	27,40	248,2	HV	100	40x
0,15	mm	28,23	28,09	233,8	HV	100	40x
0,30	mm	27,40	27,82	243,2	HV	100	40x
0,30	mm	27,54	27,82	242,0	HV	100	40x
0,30	mm	28,78	27,96	230,4	HV	100	40x
0,30	mm	26,99	26,17	262,5	HV	100	40x
0,30	mm	28,37	27,82	235,0	HV	100	40x
0,30	mm	27,96	27,27	243,2	HV	100	40x
0,30	mm	27,54	28,09	239,6	HV	100	40x
0,30	mm	28,37	27,68	236,1	HV	100	40x
0,30	mm	27,96	27,13	244,5	HV	100	40x
0,30	mm	27,13	27,54	248,2	HV	100	40x
0,45	mm	28,51	28,09	231,5	HV	100	40x
0,45	mm	27,82	27,54	242,0	HV	100	40x

0,45	mm	30,71	29,47	204,8	HV	100	40x
0,45	mm	28,23	27,54	238,5	HV	100	40x
0,45	mm	26,44	26,30	266,6	HV	100	40x
0,45	mm	29,06	29,47	216,5	HV	100	40x
0,45	mm	28,51	28,23	230,4	HV	100	40x
0,45	mm	26,99	27,40	250,7	HV	100	40x
0,45	mm	27,96	27,82	238,5	HV	100	40x
0,45	mm	28,23	29,33	223,9	HV	100	40x
0,60	mm	42,14	33,88	128,4	HV	100	40x
0,60	mm	28,51	28,23	230,4	HV	100	40x
0,60	mm	28,23	27,68	237,3	HV	100	40x
0,60	mm	27,82	27,96	238,5	HV	100	40x
0,60	mm	27,82	27,82	239,6	HV	100	40x
0,60	mm	28,64	28,37	228,2	HV	100	40x
0,60	mm	26,99	26,85	255,8	HV	100	40x
0,60	mm	26,99	27,40	250,7	HV	100	40x
0,60	mm	27,27	26,72	254,5	HV	100	40x
0,60	mm	28,92	28,09	228,2	HV	100	40x
0,75	mm	28,92	28,09	228,2	HV	100	40x
0,75	mm	28,09	28,78	229,3	HV	100	40x
0,75	mm	27,54	27,68	243,2	HV	100	40x
0,75	mm	27,40	27,40	246,9	HV	100	40x
0,75	mm	27,40	27,54	245,7	HV	100	40x
0,75	mm	27,40	26,85	252,0	HV	100	40x
0,75	mm	26,72	27,27	254,5	HV	100	40x
0,75	mm	26,99	26,72	257,2	HV	100	40x
0,75	mm	27,54	27,40	245,7	HV	100	40x
0,75	mm	28,23	27,82	236,1	HV	100	40x
0,90	mm	28,23	28,51	230,4	HV	100	40x
0,90	mm	27,82	28,51	233,8	HV	100	40x
0,90	mm	27,27	27,27	249,4	HV	100	40x
0,90	mm	27,82	26,85	248,2	HV	100	40x
0,90	mm	28,09	27,96	236,1	HV	100	40x
0,90	mm	28,23	28,92	227,1	HV	100	40x
0,90	mm	27,13	27,27	250,7	HV	100	40x
0,90	mm	28,09	27,68	238,5	HV	100	40x
0,90	mm	27,82	28,23	236,1	HV	100	40x
0,90	mm	27,54	27,96	240,8	HV	100	40x
1,05	mm	27,13	27,96	244,5	HV	100	40x
1,05	mm	27,54	27,82	242,0	HV	100	40x
1,05	mm	26,17	27,13	261,2	HV	100	40x
1,05	mm	27,40	27,54	245,7	HV	100	40x
1,05	mm	27,40	27,40	246,9	HV	100	40x
1,05	mm	28,51	27,96	232,7	HV	100	40x
1,05	mm	28,23	27,27	240,8	HV	100	40x
1,05	mm	28,92	28,78	222,8	HV	100	40x
1,05	mm	27,68	27,54	243,2	HV	100	40x
1,05	mm	27,82	28,09	237,3	HV	100	40x
1,20	mm	27,82	28,09	237,3	HV	100	40x
1,20	mm	27,27	27,54	246,9	HV	100	40x
1,20	mm	27,13	26,99	253,2	HV	100	40x

1,20	mm	26,44	26,72	262,5	HV	100	40x
1,20	mm	27,68	27,82	240,8	HV	100	40x
1,20	mm	28,37	27,40	238,5	HV	100	40x
1,20	mm	28,37	28,78	227,1	HV	100	40x
1,20	mm	27,13	27,54	248,2	HV	100	40x
1,20	mm	27,13	26,72	255,8	HV	100	40x
1,20	mm	27,27	26,44	257,2	HV	100	40x
1,35	mm	27,13	27,54	248,2	HV	100	40x
1,35	mm	26,99	26,99	254,5	HV	100	40x
1,35	mm	27,13	27,40	249,4	HV	100	40x
1,35	mm	27,54	26,72	252,0	HV	100	40x
1,35	mm	28,37	27,40	238,5	HV	100	40x
1,35	mm	28,09	28,37	232,7	HV	100	40x
1,35	mm	27,96	27,40	242,0	HV	100	40x
1,35	mm	28,64	28,37	228,2	HV	100	40x
1,35	mm	28,09	27,96	236,1	HV	100	40x
1,35	mm	27,68	27,96	239,6	HV	100	40x

Table 8.54: micro hardness measurements results with 100 N load from the center of the plate for SS1672

SS 2348 (surface)

Depth		**D1 (µm)**	**D2 (µm)**	**Hardness**		**Load (gf)**	**Obj**
0,00	mm	33,33	32,91	169,1	HV	100	40x
0,00	mm	33,33	34,01	163,6	HV	100	40x
0,00	mm	33,88	33,88	161,6	HV	100	40x
0,00	mm	32,91	33,46	168,4	HV	100	40x
0,00	mm	34,43	33,60	160,3	HV	100	40x
0,00	mm	33,46	33,74	164,2	HV	100	40x
0,00	mm	33,19	33,60	166,3	HV	100	40x
0,00	mm	33,60	32,09	171,9	HV	100	40x
0,00	mm	33,19	33,33	167,7	HV	100	40x
0,00	mm	33,88	34,01	160,9	HV	100	40x
0,15	mm	31,81	33,05	176,3	HV	100	40x
0,15	mm	33,46	34,01	162,9	HV	100	40x
0,15	mm	33,60	34,29	160,9	HV	100	40x
0,15	mm	33,74	33,46	164,2	HV	100	40x
0,15	mm	33,33	32,91	169,1	HV	100	40x
0,15	mm	32,78	33,60	168,4	HV	100	40x
0,15	mm	32,78	33,88	167,0	HV	100	40x
0,15	mm	33,60	34,01	162,2	HV	100	40x
0,15	mm	34,29	32,91	164,2	HV	100	40x
0,15	mm	32,50	33,88	168,4	HV	100	40x
0,30	mm	34,15	35,12	154,6	HV	100	40x
0,30	mm	33,60	33,88	162,9	HV	100	40x
0,30	mm	33,74	33,46	164,2	HV	100	40x
0,30	mm	35,67	34,15	152,2	HV	100	40x
0,30	mm	32,22	32,91	174,8	HV	100	40x
0,30	mm	32,36	32,50	176,3	HV	100	40x
0,30	mm	33,05	34,01	164,9	HV	100	40x
0,30	mm	33,33	33,19	167,7	HV	100	40x

0,30	mm	34,43	33,60	160,3	HV	100	40x
0,30	mm	32,91	33,46	168,4	HV	100	40x
0,45	mm	34,43	33,05	162,9	HV	100	40x
0,45	mm	35,81	34,84	148,6	HV	100	40x
0,45	mm	32,91	32,91	171,2	HV	100	40x
0,45	mm	37,04	36,22	138,2	HV	100	40x
0,45	mm	34,01	33,46	162,9	HV	100	40x
0,45	mm	33,60	33,46	164,9	HV	100	40x
0,45	mm	33,19	33,33	167,7	HV	100	40x
0,45	mm	33,33	34,01	163,6	HV	100	40x
0,45	mm	33,60	34,29	160,9	HV	100	40x
0,45	mm	34,43	32,91	163,6	HV	100	40x
0,60	mm	38,15	37,46	129,8	HV	100	40x
0,60	mm	34,70	34,43	155,2	HV	100	40x
0,60	mm	34,70	33,88	157,7	HV	100	40x
0,60	mm	33,46	32,78	169,1	HV	100	40x
0,60	mm	34,43	33,60	160,3	HV	100	40x
0,60	mm	35,25	35,39	148,6	HV	100	40x
0,60	mm	34,43	33,88	159,0	HV	100	40x
0,60	mm	33,46	33,60	164,9	HV	100	40x
0,60	mm	34,29	33,60	160,9	HV	100	40x
0,60	mm	32,78	34,15	165,6	HV	100	40x
0,75	mm	35,53	35,81	145,8	HV	100	40x
0,75	mm	34,84	34,70	153,4	HV	100	40x
0,75	mm	33,74	34,70	158,3	HV	100	40x
0,75	mm	33,19	34,29	162,9	HV	100	40x
0,75	mm	34,84	34,57	154,0	HV	100	40x
0,75	mm	33,05	33,05	169,8	HV	100	40x
0,75	mm	33,46	32,78	169,1	HV	100	40x
0,75	mm	33,88	34,01	160,9	HV	100	40x
0,75	mm	33,46	32,36	171,2	HV	100	40x
0,75	mm	34,70	35,39	151,0	HV	100	40x
0,90	mm	44,07	39,66	105,8	HV	100	40x
0,90	mm	34,01	33,88	160,9	HV	100	40x
0,90	mm	33,60	33,33	165,6	HV	100	40x
0,90	mm	34,70	34,70	154,0	HV	100	40x
0,90	mm	34,01	34,70	157,1	HV	100	40x
0,90	mm	34,98	33,33	159,0	HV	100	40x
0,90	mm	35,39	34,70	151,0	HV	100	40x
0,90	mm	34,70	34,01	157,1	HV	100	40x
0,90	mm	33,60	33,88	162,9	HV	100	40x
0,90	mm	33,74	32,91	167,0	HV	100	40x
1,05	mm	35,12	35,81	147,5	HV	100	40x
1,05	mm	35,25	32,91	159,6	HV	100	40x
1,05	mm	33,88	34,43	159,0	HV	100	40x
1,05	mm	34,01	33,46	162,9	HV	100	40x
1,05	mm	34,01	33,74	161,6	HV	100	40x
1,05	mm	33,33	33,88	164,2	HV	100	40x
1,05	mm	34,57	34,29	156,5	HV	100	40x
1,05	mm	33,19	33,88	164,9	HV	100	40x
1,05	mm	34,84	34,84	152,8	HV	100	40x

1,05	mm	34,43	34,70	155,2	HV	100	40x
1,20	mm	44,76	40,21	102,7	HV	100	40x
1,20	mm	34,43	33,19	162,2	HV	100	40x
1,20	mm	33,74	33,46	164,2	HV	100	40x
1,20	mm	33,74	34,70	158,3	HV	100	40x
1,20	mm	34,15	33,88	160,3	HV	100	40x
1,20	mm	34,29	33,88	159,6	HV	100	40x
1,20	mm	33,19	32,78	170,5	HV	100	40x
1,20	mm	34,29	33,46	161,6	HV	100	40x
1,20	mm	33,60	33,46	164,9	HV	100	40x
1,20	mm	33,88	33,88	161,6	HV	100	40x
1,35	mm	42,00	39,25	112,4	HV	100	40x
1,35	mm	34,57	33,74	159,0	HV	100	40x
1,35	mm	32,78	33,19	170,5	HV	100	40x
1,35	mm	34,98	34,29	154,6	HV	100	40x
1,35	mm	34,15	34,70	156,5	HV	100	40x
1,35	mm	33,74	34,70	158,3	HV	100	40x
1,35	mm	33,88	34,01	160,9	HV	100	40x
1,35	mm	33,60	33,19	166,3	HV	100	40x
1,35	mm	34,29	34,43	157,1	HV	100	40x
1,35	mm	34,15	33,74	160,9	HV	100	40x

Table 8.55: micro hardness measurements results with 100 N load from the surface of the plate for SS2348

SS 2348 (center)

Depth		**D1 (µm)**	**D2 (µm)**	**Hardness**		**Load (gf)**	**Obj**
0,00	mm	34,70	34,29	155,8	HV	100	40x
0,00	mm	35,67	35,67	145,8	HV	100	40x
0,00	mm	35,39	34,29	152,8	HV	100	40x
0,00	mm	35,67	34,84	149,2	HV	100	40x
0,00	mm	32,78	33,19	170,5	HV	100	40x
0,00	mm	33,88	34,98	156,5	HV	100	40x
0,00	mm	34,43	34,84	154,6	HV	100	40x
0,00	mm	34,43	35,12	153,4	HV	100	40x
0,00	mm	34,98	34,98	151,6	HV	100	40x
0,00	mm	33,74	33,74	162,9	HV	100	40x
0,15	mm	33,60	33,19	166,3	HV	100	40x
0,15	mm	34,29	33,33	162,2	HV	100	40x
0,15	mm	34,29	35,12	154,0	HV	100	40x
0,15	mm	34,01	35,67	152,8	HV	100	40x
0,15	mm	33,88	33,33	164,2	HV	100	40x
0,15	mm	35,25	34,98	150,4	HV	100	40x
0,15	mm	34,29	34,01	159,0	HV	100	40x
0,15	mm	34,15	34,01	159,6	HV	100	40x
0,15	mm	36,08	36,49	140,8	HV	100	40x
0,15	mm	34,57	34,43	155,8	HV	100	40x
0,30	mm	36,49	37,46	135,6	HV	100	40x
0,30	mm	35,39	35,39	148,0	HV	100	40x
0,30	mm	34,43	35,39	152,2	HV	100	40x

0,30	mm	35,67	35,12	148,0	HV	100	40x
0,30	mm	32,64	31,81	178,6	HV	100	40x
0,30	mm	34,15	34,98	155,2	HV	100	40x
0,30	mm	35,67	34,57	150,4	HV	100	40x
0,30	mm	33,74	34,57	159,0	HV	100	40x
0,30	mm	35,25	34,29	153,4	HV	100	40x
0,30	mm	34,70	35,25	151,6	HV	100	40x
0,45	mm	43,79	39,66	106,5	HV	100	40x
0,45	mm	35,12	34,70	152,2	HV	100	40x
0,45	mm	35,25	34,01	154,6	HV	100	40x
0,45	mm	36,08	33,88	151,6	HV	100	40x
0,45	mm	33,88	34,01	160,9	HV	100	40x
0,45	mm	34,98	34,98	151,6	HV	100	40x
0,45	mm	34,84	33,60	158,3	HV	100	40x
0,45	mm	34,15	34,70	156,5	HV	100	40x
0,45	mm	33,60	35,67	154,6	HV	100	40x
0,45	mm	33,88	34,15	160,3	HV	100	40x
0,60	mm	37,18	35,25	141,4	HV	100	40x
0,60	mm	34,29	34,43	157,1	HV	100	40x
0,60	mm	32,50	33,19	171,9	HV	100	40x
0,60	mm	37,18	38,42	129,8	HV	100	40x
0,60	mm	33,74	34,84	157,7	HV	100	40x
0,60	mm	33,74	34,29	160,3	HV	100	40x
0,60	mm	33,88	34,98	156,5	HV	100	40x
0,60	mm	35,12	34,57	152,8	HV	100	40x
0,60	mm	33,05	34,43	162,9	HV	100	40x
0,60	mm	35,39	34,70	151,0	HV	100	40x
0,75	mm	35,39	35,25	148,6	HV	100	40x
0,75	mm	35,12	34,43	153,4	HV	100	40x
0,75	mm	34,98	35,39	149,8	HV	100	40x
0,75	mm	35,25	35,12	149,8	HV	100	40x
0,75	mm	35,25	34,84	151,0	HV	100	40x
0,75	mm	34,98	35,81	148,0	HV	100	40x
0,75	mm	34,01	34,29	159,0	HV	100	40x
0,75	mm	34,43	34,43	156,5	HV	100	40x
0,75	mm	34,43	34,70	155,2	HV	100	40x
0,75	mm	36,22	34,98	146,3	HV	100	40x
0,90	mm	35,67	36,08	144,1	HV	100	40x
0,90	mm	35,67	35,25	147,5	HV	100	40x
0,90	mm	34,98	34,01	155,8	HV	100	40x
0,90	mm	34,15	34,84	155,8	HV	100	40x
0,90	mm	35,39	35,39	148,0	HV	100	40x
0,90	mm	34,70	34,29	155,8	HV	100	40x
0,90	mm	34,43	34,29	157,1	HV	100	40x
0,90	mm	35,12	34,98	151,0	HV	100	40x
0,90	mm	34,57	34,84	154,0	HV	100	40x
0,90	mm	35,25	35,39	148,6	HV	100	40x
1,05	mm	36,49	37,18	136,7	HV	100	40x
1,05	mm	35,39	34,98	149,8	HV	100	40x
1,05	mm	33,60	34,29	160,9	HV	100	40x
1,05	mm	34,98	33,05	160,3	HV	100	40x

1,05	mm	34,15	34,43	157,7	HV	100	40x
1,05	mm	36,08	34,70	148,0	HV	100	40x
1,05	mm	35,81	34,98	148,0	HV	100	40x
1,05	mm	35,39	34,29	152,8	HV	100	40x
1,05	mm	33,74	33,60	163,6	HV	100	40x
1,05	mm	32,91	33,19	169,8	HV	100	40x
1,20	mm	37,60	38,28	128,8	HV	100	40x
1,20	mm	35,25	34,57	152,2	HV	100	40x
1,20	mm	35,25	35,12	149,8	HV	100	40x
1,20	mm	34,70	34,84	153,4	HV	100	40x
1,20	mm	34,98	36,22	146,3	HV	100	40x
1,20	mm	33,88	33,19	164,9	HV	100	40x
1,20	mm	34,01	34,43	158,3	HV	100	40x
1,20	mm	34,29	34,29	157,7	HV	100	40x
1,20	mm	34,84	34,43	154,6	HV	100	40x
1,20	mm	34,98	34,98	151,6	HV	100	40x
1,35	mm	35,53	35,53	146,9	HV	100	40x
1,35	mm	34,98	34,84	152,2	HV	100	40x
1,35	mm	34,43	35,25	152,8	HV	100	40x
1,35	mm	33,46	33,60	164,9	HV	100	40x
1,35	mm	34,57	35,67	150,4	HV	100	40x
1,35	mm	34,70	35,12	152,2	HV	100	40x
1,35	mm	35,25	35,39	148,6	HV	100	40x
1,35	mm	34,84	34,98	152,2	HV	100	40x
1,35	mm	33,60	33,60	164,2	HV	100	40x
1,35	mm	34,01	34,57	157,7	HV	100	40x

Table 8.56: micro hardness measurements results with 100 N load from the center of the plate for SS2348

SAF 2205 (surface)

Depth		**D1 (µm)**	**D2 (µm)**	**Hardness**		**Load (gf)**	**Obj**
0,00	mm	27,54	26,58	253,2	HV	100	40x
0,00	mm	27,68	27,40	244,5	HV	100	40x
0,00	mm	27,27	27,27	249,4	HV	100	40x
0,00	mm	27,68	27,27	245,7	HV	100	40x
0,00	mm	26,85	26,99	255,8	HV	100	40x
0,00	mm	28,23	28,09	233,8	HV	100	40x
0,00	mm	29,19	27,27	232,7	HV	100	40x
0,00	mm	28,09	28,09	235,0	HV	100	40x
0,00	mm	27,27	27,13	250,7	HV	100	40x
0,00	mm	28,23	28,78	228,2	HV	100	40x
0,15	mm	27,82	27,13	245,7	HV	100	40x
0,15	mm	27,40	27,40	246,9	HV	100	40x
0,15	mm	28,23	27,40	239,6	HV	100	40x
0,15	mm	27,54	27,96	240,8	HV	100	40x
0,15	mm	27,27	26,44	257,2	HV	100	40x
0,15	mm	26,72	26,85	258,5	HV	100	40x
0,15	mm	27,40	26,72	253,2	HV	100	40x

0,15	mm	26,44	27,40	255,8	HV	100	40x
0,15	mm	27,13	26,72	255,8	HV	100	40x
0,15	mm	26,72	27,68	250,7	HV	100	40x
0,30	mm	26,58	26,72	261,2	HV	100	40x
0,30	mm	27,40	26,99	250,7	HV	100	40x
0,30	mm	27,40	27,40	246,9	HV	100	40x
0,30	mm	28,37	27,68	236,1	HV	100	40x
0,30	mm	27,27	28,37	239,6	HV	100	40x
0,30	mm	27,27	27,68	245,7	HV	100	40x
0,30	mm	27,54	27,13	248,2	HV	100	40x
0,30	mm	27,27	26,99	252,0	HV	100	40x
0,30	mm	26,99	27,68	248,2	HV	100	40x
0,30	mm	26,85	27,54	250,7	HV	100	40x
0,45	mm	28,23	27,54	238,5	HV	100	40x
0,45	mm	26,99	26,72	257,2	HV	100	40x
0,45	mm	28,23	28,51	230,4	HV	100	40x
0,45	mm	26,85	27,40	252,0	HV	100	40x
0,45	mm	28,51	27,54	236,1	HV	100	40x
0,45	mm	26,99	27,40	250,7	HV	100	40x
0,45	mm	26,58	27,13	257,2	HV	100	40x
0,45	mm	28,51	27,68	235,0	HV	100	40x
0,45	mm	27,13	26,44	258,5	HV	100	40x
0,45	mm	27,68	27,54	243,2	HV	100	40x
0,60	mm	27,54	27,13	248,2	HV	100	40x
0,60	mm	28,23	28,78	228,2	HV	100	40x
0,60	mm	26,99	28,23	243,2	HV	100	40x
0,60	mm	27,96	26,72	248,2	HV	100	40x
0,60	mm	27,40	26,85	252,0	HV	100	40x
0,60	mm	27,13	27,27	250,7	HV	100	40x
0,60	mm	26,99	27,13	253,2	HV	100	40x
0,60	mm	27,96	27,40	242,0	HV	100	40x
0,60	mm	26,85	27,40	252,0	HV	100	40x
0,60	mm	27,96	27,54	240,8	HV	100	40x
0,75	mm	26,72	26,72	259,8	HV	100	40x
0,75	mm	26,58	26,58	262,5	HV	100	40x
0,75	mm	26,85	26,72	258,5	HV	100	40x
0,75	mm	26,44	27,27	257,2	HV	100	40x
0,75	mm	27,54	27,54	244,5	HV	100	40x
0,75	mm	27,27	27,82	244,5	HV	100	40x
0,75	mm	26,72	27,27	254,5	HV	100	40x
0,75	mm	27,82	27,54	242,0	HV	100	40x
0,75	mm	28,09	27,13	243,2	HV	100	40x
0,75	mm	28,23	27,96	235,0	HV	100	40x
0,90	mm	27,82	27,68	240,8	HV	100	40x
0,90	mm	26,85	27,27	253,2	HV	100	40x
0,90	mm	26,85	26,58	259,8	HV	100	40x
0,90	mm	26,72	26,44	262,5	HV	100	40x
0,90	mm	26,30	27,13	259,8	HV	100	40x
0,90	mm	26,44	26,58	263,9	HV	100	40x
0,90	mm	28,37	27,68	236,1	HV	100	40x
0,90	mm	26,85	28,09	245,7	HV	100	40x

0,90	mm	26,85	27,68	249,4	HV	100	40x
0,90	mm	28,09	27,54	239,6	HV	100	40x
1,05	mm	27,13	26,85	254,5	HV	100	40x
1,05	mm	26,99	26,72	257,2	HV	100	40x
1,05	mm	26,99	27,27	252,0	HV	100	40x
1,05	mm	27,13	27,13	252,0	HV	100	40x
1,05	mm	27,54	27,13	248,2	HV	100	40x
1,05	mm	26,03	26,44	269,4	HV	100	40x
1,05	mm	27,40	28,64	236,1	HV	100	40x
1,05	mm	27,13	27,54	248,2	HV	100	40x
1,05	mm	27,40	26,99	250,7	HV	100	40x
1,05	mm	26,17	26,17	270,9	HV	100	40x
1,20	mm	27,68	27,13	246,9	HV	100	40x
1,20	mm	27,27	26,30	258,5	HV	100	40x
1,20	mm	26,30	26,44	266,6	HV	100	40x
1,20	mm	27,13	26,58	257,2	HV	100	40x
1,20	mm	27,68	27,82	240,8	HV	100	40x
1,20	mm	27,40	27,82	243,2	HV	100	40x
1,20	mm	28,51	27,54	236,1	HV	100	40x
1,20	mm	26,85	27,40	252,0	HV	100	40x
1,20	mm	27,82	27,82	239,6	HV	100	40x
1,20	mm	27,54	27,54	244,5	HV	100	40x
1,35	mm	26,30	27,40	257,2	HV	100	40x
1,35	mm	26,58	27,13	257,2	HV	100	40x
1,35	mm	27,27	27,54	246,9	HV	100	40x
1,35	mm	27,54	27,27	246,9	HV	100	40x
1,35	mm	26,99	27,54	249,4	HV	100	40x
1,35	mm	27,27	27,68	245,7	HV	100	40x
1,35	mm	27,54	27,96	240,8	HV	100	40x
1,35	mm	26,85	27,27	253,2	HV	100	40x
1,35	mm	27,96	27,27	243,2	HV	100	40x
1,35	mm	26,72	27,13	255,8	HV	100	40x

Table 8.57: micro hardness measurements results with 100 N load from the surface of the plate for SAF2205

SAF 2205 (center)

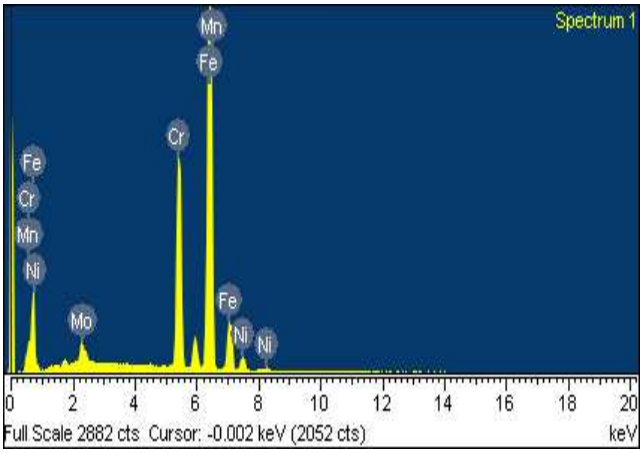
Depth		**D1 (µm)**	**D2 (µm)**	**Hardness**		**Load (gf)**	**Obj**
0,00	mm	27,54	28,23	238,5	HV	100	40x
0,00	mm	28,09	27,40	240,8	HV	100	40x
0,00	mm	27,40	27,82	243,2	HV	100	40x
0,00	mm	28,23	27,68	237,3	HV	100	40x
0,00	mm	26,99	28,09	244,5	HV	100	40x
0,00	mm	27,68	27,82	240,8	HV	100	40x
0,00	mm	26,85	27,27	253,2	HV	100	40x
0,00	mm	28,92	27,82	230,4	HV	100	40x
0,00	mm	26,44	26,99	259,8	HV	100	40x
0,00	mm	27,68	27,96	239,6	HV	100	40x
0,15	mm	28,09	27,13	243,2	HV	100	40x
0,15	mm	27,96	27,68	239,6	HV	100	40x
0,15	mm	28,23	28,09	233,8	HV	100	40x

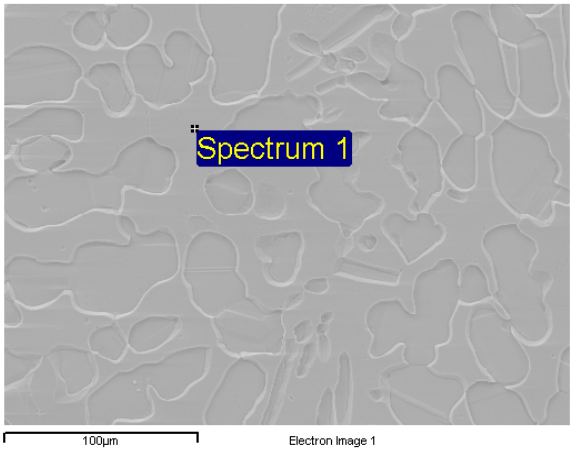
0,15	mm	27,54	27,40	245,7	HV	100	40x
0,15	mm	27,27	29,19	232,7	HV	100	40x
0,15	mm	26,72	27,40	253,2	HV	100	40x
0,15	mm	27,54	26,99	249,4	HV	100	40x
0,15	mm	27,13	27,82	245,7	HV	100	40x
0,15	mm	27,68	27,40	244,5	HV	100	40x
0,15	mm	27,54	26,72	252,0	HV	100	40x
0,30	mm	27,82	27,96	238,5	HV	100	40x
0,30	mm	26,85	24,93	276,7	HV	100	40x
0,30	mm	27,27	27,68	245,7	HV	100	40x
0,30	mm	28,09	28,37	232,7	HV	100	40x
0,30	mm	26,58	27,27	255,8	HV	100	40x
0,30	mm	27,54	27,82	242,0	HV	100	40x
0,30	mm	28,09	27,68	238,5	HV	100	40x
0,30	mm	27,40	26,99	250,7	HV	100	40x
0,30	mm	28,23	27,96	235,0	HV	100	40x
0,30	mm	28,51	28,09	231,5	HV	100	40x
0,45	mm	27,96	28,37	233,8	HV	100	40x
0,45	mm	26,44	27,13	258,5	HV	100	40x
0,45	mm	27,96	28,09	236,1	HV	100	40x
0,45	mm	27,96	28,23	235,0	HV	100	40x
0,45	mm	26,72	26,72	259,8	HV	100	40x
0,45	mm	28,09	28,64	230,4	HV	100	40x
0,45	mm	27,40	26,99	250,7	HV	100	40x
0,45	mm	27,13	27,27	250,7	HV	100	40x
0,45	mm	27,68	26,72	250,7	HV	100	40x
0,45	mm	27,68	27,82	240,8	HV	100	40x
0,60	mm	27,13	27,54	248,2	HV	100	40x
0,60	mm	28,09	27,68	238,5	HV	100	40x
0,60	mm	27,13	27,27	250,7	HV	100	40x
0,60	mm	27,68	28,23	237,3	HV	100	40x
0,60	mm	26,99	27,13	253,2	HV	100	40x
0,60	mm	26,17	26,99	262,5	HV	100	40x
0,60	mm	26,58	26,72	261,2	HV	100	40x
0,60	mm	27,40	28,23	239,6	HV	100	40x
0,60	mm	26,72	27,54	252,0	HV	100	40x
0,60	mm	27,40	27,54	245,7	HV	100	40x
0,75	mm	27,96	28,51	232,7	HV	100	40x
0,75	mm	27,68	28,09	238,5	HV	100	40x
0,75	mm	28,51	26,99	240,8	HV	100	40x
0,75	mm	27,27	26,44	257,2	HV	100	40x
0,75	mm	26,85	27,40	252,0	HV	100	40x
0,75	mm	28,51	27,40	237,3	HV	100	40x
0,75	mm	27,96	26,30	252,0	HV	100	40x
0,75	mm	28,51	27,82	233,8	HV	100	40x
0,75	mm	27,54	28,09	239,6	HV	100	40x
0,75	mm	27,96	28,78	230,4	HV	100	40x
0,90	mm	32,91	31,26	180,1	HV	100	40x
0,90	mm	27,27	28,09	242,0	HV	100	40x
0,90	mm	27,96	28,92	229,3	HV	100	40x
0,90	mm	26,85	27,82	248,2	HV	100	40x

0,90	mm	27,13	27,40	249,4	HV	100	40x
0,90	mm	27,40	27,54	245,7	HV	100	40x
0,90	mm	26,99	27,13	253,2	HV	100	40x
0,90	mm	27,54	26,58	253,2	HV	100	40x
0,90	mm	26,99	27,68	248,2	HV	100	40x
0,90	mm	28,37	28,37	230,4	HV	100	40x
1,05	mm	35,12	32,22	163,6	HV	100	40x
1,05	mm	27,54	26,99	249,4	HV	100	40x
1,05	mm	26,72	27,13	255,8	HV	100	40x
1,05	mm	26,85	26,85	257,2	HV	100	40x
1,05	mm	26,03	27,27	261,2	HV	100	40x
1,05	mm	28,51	28,37	229,3	HV	100	40x
1,05	mm	26,99	28,37	242,0	HV	100	40x
1,05	mm	27,54	27,27	246,9	HV	100	40x
1,05	mm	26,99	27,40	250,7	HV	100	40x
1,05	mm	26,72	27,68	250,7	HV	100	40x
1,20	mm	39,11	32,78	143,5	HV	100	40x
1,20	mm	27,68	27,54	243,2	HV	100	40x
1,20	mm	28,92	27,96	229,3	HV	100	40x
1,20	mm	31,67	25,34	228,2	HV	100	40x
1,20	mm	27,82	27,54	242,0	HV	100	40x
1,20	mm	27,40	27,27	248,2	HV	100	40x
1,20	mm	27,54	27,13	248,2	HV	100	40x
1,20	mm	27,68	27,82	240,8	HV	100	40x
1,20	mm	27,68	27,96	239,6	HV	100	40x
1,20	mm	26,99	27,82	246,9	HV	100	40x
1,35	mm	35,39	31,12	167,7	HV	100	40x
1,35	mm	27,82	29,19	228,2	HV	100	40x
1,35	mm	27,68	28,51	235,0	HV	100	40x
1,35	mm	26,85	27,13	254,5	HV	100	40x
1,35	mm	27,68	27,40	244,5	HV	100	40x
1,35	mm	27,40	26,99	250,7	HV	100	40x
1,35	mm	27,40	27,54	245,7	HV	100	40x
1,35	mm	28,37	26,72	244,5	HV	100	40x
1,35	mm	27,13	27,40	249,4	HV	100	40x
1,35	mm	26,72	26,44	262,5	HV	100	40x

Table 8.58: micro hardness measurements results with 100 N load from the center of the plate for SAF2205

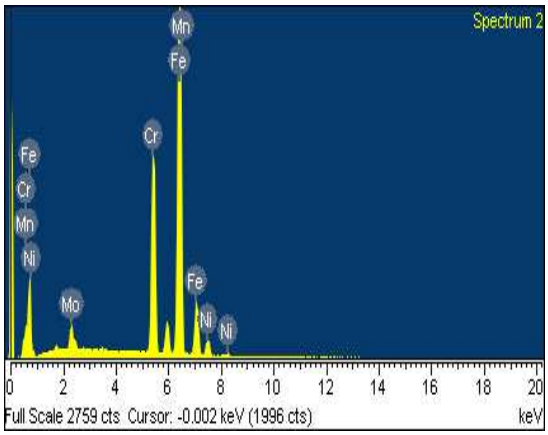
EDX results *for SAF 2205*

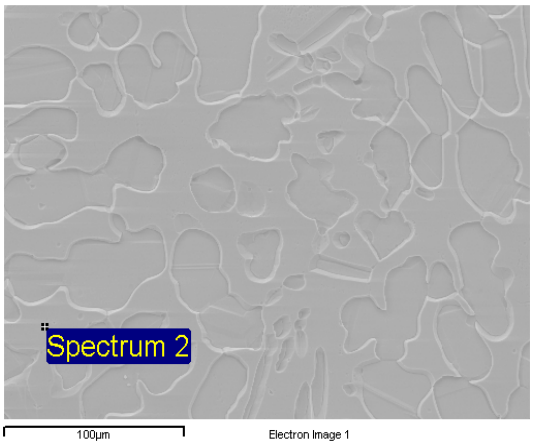




Element	Weight%	Atomic%
Cr K	24.45	26.19
Mn K	0.84	0.85
Fe K	67.68	67.48
Ni K	3.83	3.64
Mo L	3.19	1.85
Totals	100.00	

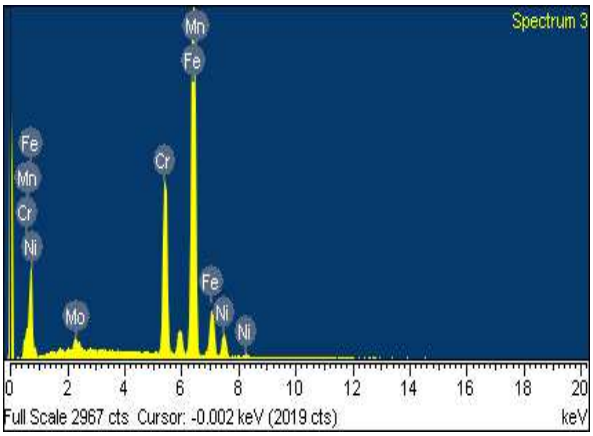
Table 8.59 EDX results for SAF 2205

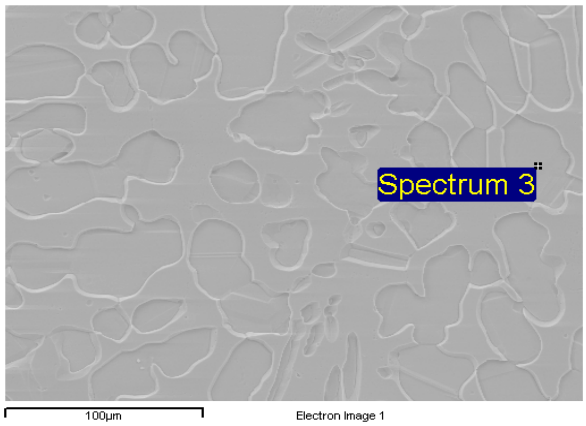




Element	Weight%	Atomic%
Cr K	24.09	25.83
Mn K	1.21	1.23
Fe K	67.26	67.12
Ni K	4.09	3.88
Mo L	3.35	1.95
Totals	100.00	

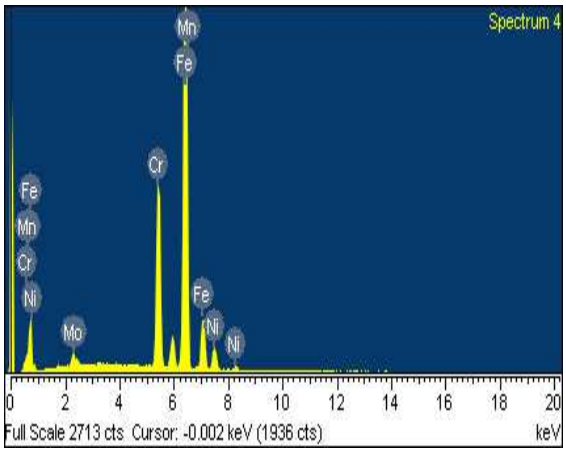
Table 8.60 EDX results for SAF 2205

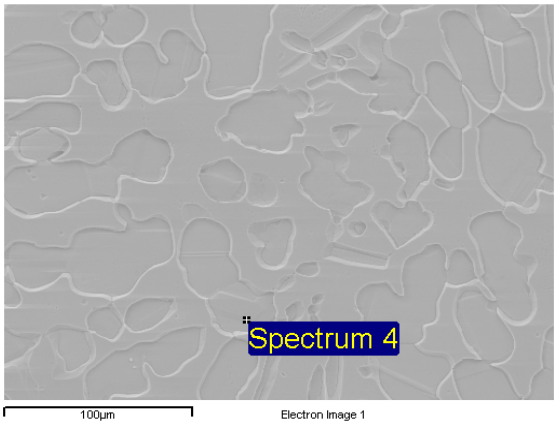




Element	Weight%	Atomic%
Cr K	21.54	23.01
Mn K	1.09	1.10
Fe K	69.31	68.93
Ni K	6.24	5.90
Mo L	1.82	1.05
Totals	100.00	

Table 8.61 EDX results for SAF 2205





Element	Weight%	Atomic%
Cr K	21.71	23.16
Mn K	1.03	1.04
Fe K	69.60	69.12
Ni K	6.17	5.82
Mo L	1.50	0.86
Totals	100.00	

Table 8.62 EDX results for SAF 2205