INDUSTRIAL TRAINING FIELD REPORT

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LI Duration: 17 WEEKS (22 MARCH 2021- 15 JULY 2021)

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Acknowledgement

First of all, I would like to express my gratitude to Almighty Allah for giving me opportunity, determination, and strength to complete this internship. Without His continuous grace and mercy, this achievement would not have been possible for me.

Completing this internship consume a huge amount of strength, courage, and determination. Support from other people is important for me during this internship. Therefore, I would like to extent my sincere gratitude to all of them.

I convey my sincere gratitude to my supervisor Mr. Muhammad Afiq bin Zainal Abidin, plating engineer and environmental officer of Synturn (M) Sdn.Bhd. Without his kind direction and proper guidance this internship cannot be completed successfully. Despite of his busy schedule, my supervisor keep giving guidance and generously share his tremendous knowledge, and for giving continuous motivation from the starting of this internship until the end of this internship. Then I would like to express my gratitude to Mrs Mageswari A/P Amasalam who was the technician in laboratory for his help during lab analysis during this internship. I would also like to show my gratitude towards all of the plating department staff for their kindness.

Last but not least, I would thank all of my colleagues form UiTM Kampus Pasir Gudang and other universities who have undergo the internship together for their comforting support.

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1 INTRODUCTION

Industrial training one of the compulsory course for chemical engineering student of UiTM. The minimum duration for training is 16 weeks. This industrial training is necessary to get work experiences and skills in chemical engineering industries. These skills includes the ability to communicate professionally, time management and problem solving. This course gives students to see their career path after their study in chemical engineering industries.

This internship give opportunity to me to discover new thing in chemical engineering industries. During this internship, I discovered the various plating processes. I spent 17 weeks as an intern at Synturn (M) Sdn. Bhd started form 21 march 2021 until 17 July 2021. From this internship, I got develop many skills for myself such as experimental skill, communication skill, problem solving skill and even time management. I learned on how to manage time properly to complete the task given on time. The task given helps me to develop courage and independence in order to solve problems. These skills develop my personal growth and professional life in dealing with working environment. These skill that can be use for me to pursue my future career in chemical industries.

2 COMPANY BACKGROUND

Spindex Industries Limited was founded in 1981, Spindex is a leading precision engineering manufacturer with core competencies in turning, machining, grinding, surface treatments, mechanical sub-assemblies. With a regional footprint and international reach, Spindex has its headquarters in Singapore, and 4 production locations located in China, Malaysia and Vietnam with over 2000 headcount and more than 1000 CNC equipment. Its customer base is well diversified and globally represented. For more than three decades, Spindex has partnered with customers in the image and printing, automotive, consumer, and industrial business sectors around the world.

Figure 1: Some of the Spindex product

2.1 SPINDEX LOCATION WORLWIDE

Figure 2: Spindex Industries Limited (Singapore headquater)

Figure 3: SYNTURN (M).SDN.BHD, (ULU TIRAM, JOHOR)

Figure 3: SPINDEX PRECISION ENGINEERING (SHANGHAI) CO., LTD (SHANGHAI,CHINA)

Figure 4: SPINDEX PRECISION ENGINEERING (SUZHOU) CO., LTD (SUZHOU,CHINA)

Figure 5: SPINDEX INDUSTRIES (HANOI) CO., LTD (VIETNAM)

2.2 COMPANY VISION

To be a world class and preferred precision parts solution provider for our customers globally, fostering a sustainable partnership through growth together.

2.3 COMPANY MISSION

To provide appropriate solutions to our customers that is competitive in pricing, quality and delivery

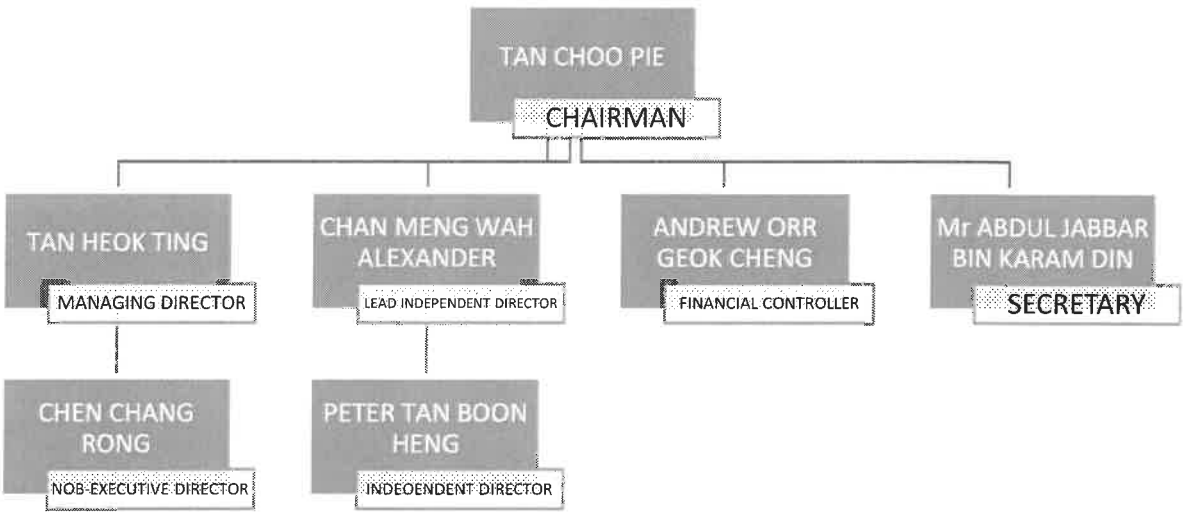
Delivering returns to our stakeholders by ensuring service excellence to our customers

To Develop a committed team, guided by our core values and passionate to achieve our vision

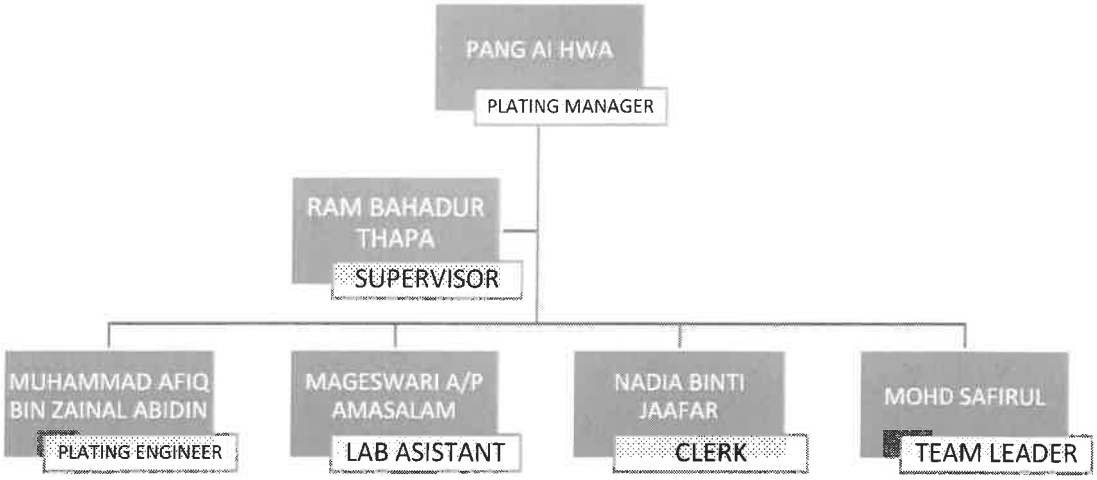
2.4 COMPANY CORE VALUES

- Customer Oriented
- Continuous Improvement and Innovation
- Accountability
- Inclusion
- Integrity
- Commitment

3 ORGANIZATION CHART

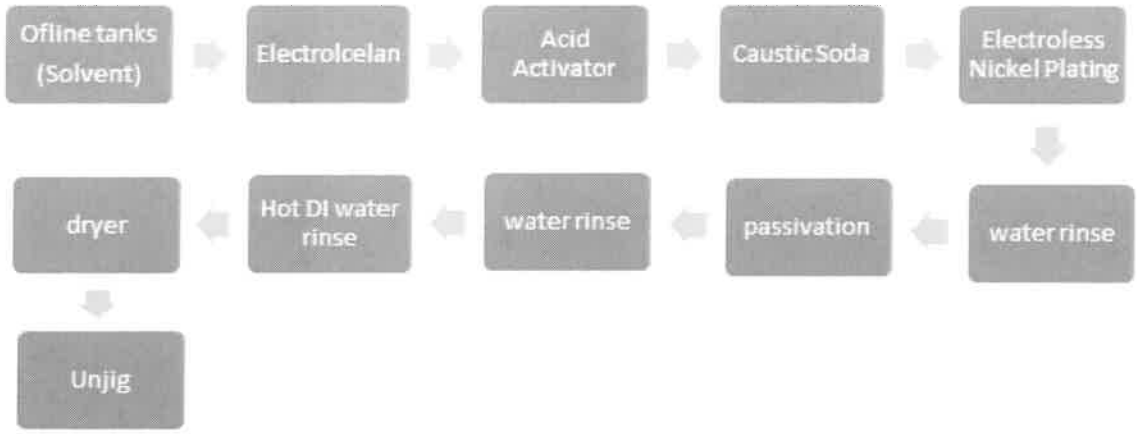


3.1 PLATING DEPARTMENT ORGANIZATION CHART



4 PROCESS FLOW

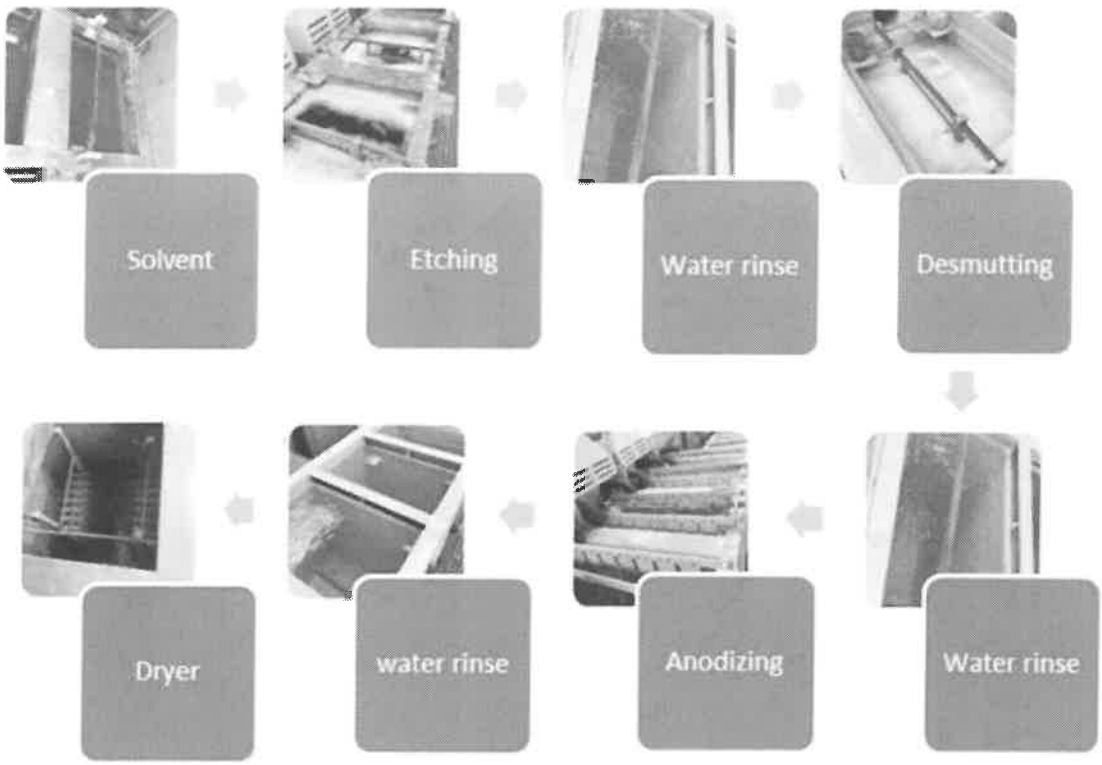
4.1 Electroless nickel-phosphorus plating process.



Electroless nickel-phosphorus plating is a chemical process that deposits nickel-phosphorus alloy on the surface of the product like metal. Before the plating process, the surface of the metal product need to be cleaned. Unwanted solids the left of the surface will cause poor plating. The cleaning is done by the series of chemical bath. The cleaning process start with the metal product (steel spool) is being immersed in the kerosene for about 20 min. After that, the steel rod is immersed in cleaning solvent for about 20 min before rinsed with di water. The steel spool then immersed in the caustic soda at pH 11-14 for 1 min before being immersed in the degreaser for about 20 min at 75c. This cleaning process is important to oil from the previous cutting process. After that the steel spool is cleaned by using di water for about 10s at room temperature to remove any residue of the cleaning chemical. After that the steel spool will undergoes the electroclean process. In this process the steel spool is immersed in alkaline bath of an electrolytic cell in the form of electrode. For this process, the jig that carries the steel spool will immersed in the electrolytic cell for about 20 min at 75c. The concentration that need to be maintained in this process is between40 - 60g/l. The jig then rinsed again with water before go to another process. The steel spool then will undergoes the surface activation process. This process is important in order to make the metal surface of the plating part become more hydrophilic. In this surface activation process, hydrochloric acid is used. The steel spool is immersed in the HCL for about 5 min at room temperature. The steel spool then rinsed again with di water to remove any acid. After that the steel spool is immersed in the caustic soda (NaOH) at room temperature for about 30s. After that the steel spool is then immersed in the plating bath. The main ingredient of this plating bath ammonia and nickel solution. In this process there are 3 types nickel solution which is (EN-A, EN-B and EN-C). The pH that need to be maintain to ensure the smooth plating process is between 4.6-5.2. The steel spool is immersed in this plating bath for about 4 hour at temperature between 83-93C. After that the steel spool is rinsed with water to remove any remaining of plating bath from the metal surface of at room temperature. The steel spool then go for another process which is passivation process. In this process the steel spool is immersed in the passivator for about 90 s at room temperature with pH of 3.5-5.0. This process is important for the metal product to become more corrosion resistant with protective oxide film. The passivation process returns the stainless steel or other metals back to its original specifications by

removing unwanted debris and oils from the surface. The jig then rinsed with di water to remove the remaining passivator. The steel spool then rinsed again with hot di water for about 30 sec before enter the dryer for about 30 min at 150c.

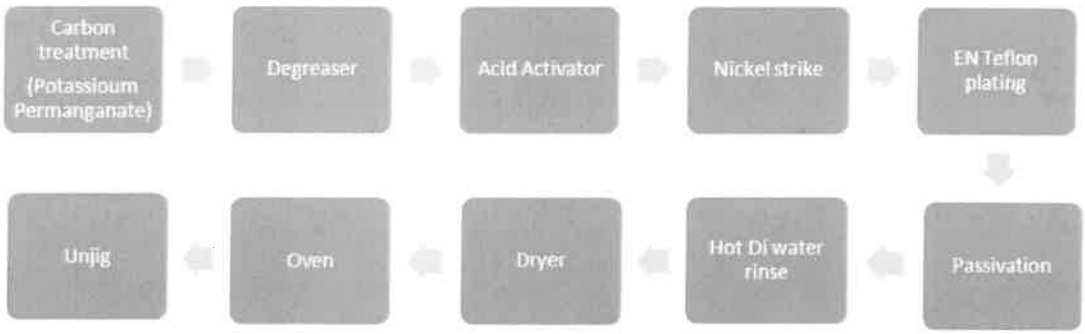
4.2 Anodizing process



Anodizing is an electrolytic process that develops an oxide coating at on the metal surface part or product. Aluminium is one of the metal that suitable for anodizing. However, others nonferrous metals, such as magnesium and titanium, also can be anodized. The anodizing process is divided into several stages which are cleaning, pre-treatment, anodizing and lastly post treatment (sealing). For the cleaning stage the aluminium spool is immerse in the solvent (D-3040) for about 0.5-2 minutes at room temperature to remove the oil from the previous production process. This solvent is changed for every 300K pieces of the aluminium spool. After that the jig of the aluminium steel spool is then rinsed by water for 3-5 dipping. After that the jig is then immerse in the degreaser (LG-800) for about 5-10 min at 70 c and pH of 8 before being rinse again by water at room temperature. This degreaser is changed for every 200K pieces of the aluminium spool. After that the jig that carries aluminium spool will undergoes pre-treatment stages where the jig that contain aluminium spool is being immerse in the tank that contain alkaline etching solution. This solution is made from the mixture of the sodium hydroxide and other additives for about 20-40 seconds and at 50-60 C. This solution is important to give matte finish to the end product. This alkaline etching solution is changed for every 200k piece of aluminium spool. The concentration that need to be maintained for the alkaline etching chemicals are sodium hydroxide (45-60g/L), HAL204-SA (3-12g/L), HAL204-AA(<70g/L) and HAL204EFS(0.5-1.0g/L).After that the aluminium spool is rinsed again by using water at room temperature for 3-5 dipping. After that the aluminium spool will undergo the desmutting process where excess alloy metal is being removed from the aluminium spool and the being rinse again with water at room temperature. After that the jig that carries aluminium spool will undergoes the main process which is the anodizing stages. In this stages the jig that carries the aluminium spool is being immerse in the anodizing solution in anodizing tank. This anodizing solution contains about the sulphuric acid 98% of

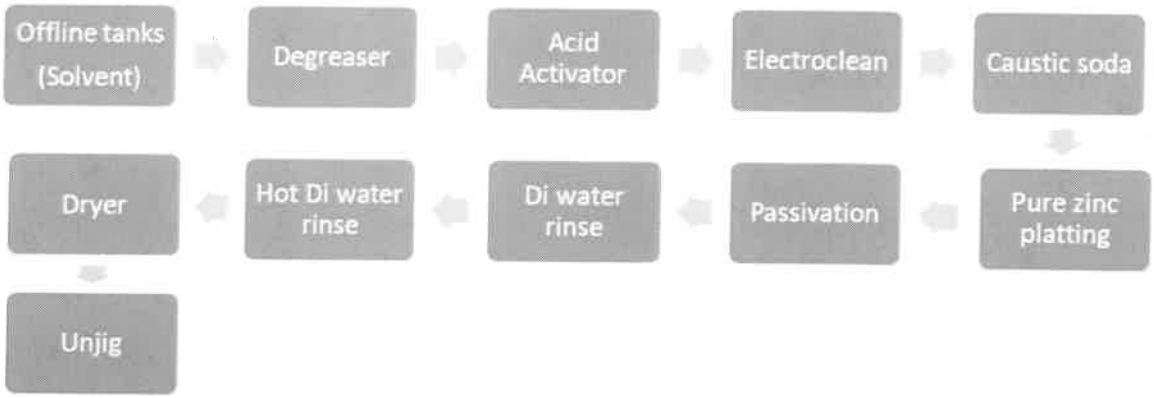
concentration and HAL-23. The jig will stay in the anodizing tank for about for about 70 min to achieve their desired thickness at temperature of -6 until -7 C with the voltage pass through the solution is 6 V . After the desired thickness is achieved the jig will undergoes post treatment stages where the jig is rinse with hot Di water for aluminium oxide interact to form a smooth, hydrated aluminium oxide surface before dried in the dryer for 20 min before the aluminium spool can be taken out from the plating jig.

4.3 Teflon plating process



The Teflon plating is divided into 3 stages which are pre-treatment, plating process and after treatment. For the pre-treatment the spool is hanged on the plating jig. Each jig carries about 400 pieces of armature. These jigs will undergoes the carbon treatment at carbon treatment line. In the carbon treatment line, the jig that carries those armatures immersed in the solvent to remove the oil for about 3-4 dipping. After that, the jig is then rinse with water at room temperature for about 20 minutes. The jig is then immersed in the potassium permanganate solution with concentration about 110 g/L for 1 hour at 100C. After that the jig is then rinse with water at room temperature for about 20 minutes. The jig then immersed in the potassium permanganate at 66-100 c for about 1 hour before being rinsed again with water at room temperature. After the jig undergoes carbon treatment, the jig will undergo Teflon plating process in plating line. The jig that carries spools is immerse in the degreaser to remove impurity from the previous carbon treatment for about 20 minutes at 55-75c before being rinsed with water at room temperature. After that jig then being immersed in the hydrochloric acid with 30-50% concentration at room temperature for 10 minutes. The jig then being rinse again with water at room temperature. The jig now immersed in the nickel chloride solution that has been mix with HCL at room temperature and with voltage of 2.5v passing through the solution for 60-300 s. The concentration of acid in this solution is about 100-200ml/L and nickel chloride is about 200-220g/L. The jig is then is being rinsed with di water. The jig then immersed in the Electroless nickel Teflon solution for about 20 minutes at 93C and pH is at 4.6-5.2. This solution contains about 4 different types of plating chemical which are EN-A, EN-B,EN-C and EN-D (Teflon). After 20 minutes the jig is then rinsed with Di water at room temperature followed by passivation. The jig then rinse with Di water at room temperature followed by Hot di water rinse before dried in the dryer for at 90 c for about 5 minutes. The jig then enter the oven for 4-5 hours at 190-200C before the armatures can be taken out from the plating jig.

4.4 Zinc plating process



The hexport is hanged on the jig. Each jig carries about 160 pieces of hexport. For the cleaning process, the jig that carries the hexport is in the kerosene and other solvent to remove the oil from the previous cutting process before being rinse by water. After that the jig is immerse in the degreaser for about 20 min at 75c. The concentration of this degreaser is maintain at 40-60g/l. After that the jig is rinse with water at room temperature. After that the jig will undergoes acid activator process where the jig that caries the hexport is being immersed in the hydrochloric acid solution (50%) at room temperature for about 5 min before being rinse again with water. After that, those hexport will undergoes electroclean process where the jig that carries the hexport is immersed in the alkaline bath of an electrolytic cell in the form of electrode. For this process, it jig will iimmresed in the electrolytic cell for about 5 min with voltage of 3.67v. The jig then rinsed again with water at room temperature. The jig then immersed in the caustic soda for 15 second at pH of 10-14. Fater that the jig will undergoes the main zinc plating process. In this process the jig is immersed in the zinc plating solution for about 30 min at 23-25c. The concentration that need to be maintain is about 90-150g/l. The jig then rinsed again with water before go to another process. After that jig will undergoes the passivation process. In this process, the hexport will immersed in passivator for about 1 min at 80c. The main purpose of this process is to make the hexport surface more passive and corrosion resistant by restoring the surface to the original characteristics with protective oxide film. The passivation process returns the stainless steel or other metals back to its original specifications by removing unwanted debris and oils from the surface. The jig than is rinsed again with water at room temperature and hot Di water before dried in the dryer for about 20 min before the hexport can be taken out from the plating jig.

5 DAILY ACTIVITY BRIEF

On the first day, I am reporting myself at Synturn (M) Sdn. Bhd. At the main offive building . At there, I was briefed about the working time schedule, dress code and overall internship procedure. As soon as I arrived at my department, I was kindly introduced to my supervisor, En. Muhammad Afiq bin Zainal Abidin who is the plating engineer and environmental officer. I was given tour at the plating department in which there are different kind of plating process available which are nickel plating, Teflon plating, pure zinc plating and anodizing. Besides that my supervisor also give tour around the factory about the whole process where how the long steel rode can be turn into small pieces of steel part that has been used in our daily appliances. However for my internship, my supervisor put me in plating department.

For the whole first week, I studied closely about how the plating process is done through observation and technician explanation. Starting from that, I start to give a helping to them such as sample collection for chemical analysis and jigging the steel part into the plating jig, separate the rejected plated part, how to measure the thickness of plated part after plating. For the following weeks, I start to learn how to conduct the chemical test for each plating process that available. I was entrusted to key in the chemical test data in a worksheet. It is actually is not an easy task since sometimes error can happen during the chemical test and give the wrong values hence the test must be repeated again. Some of the tasks is urgent thus it has to be finished in a short period of time.

Like any other intern, I was also needed to do the unrelated task. But for me it good because it can develop my communication skill and having good time management skill. Truthfully, it was a very challenging and amazing experience. Many obstacles coming along the way, but I am grateful that they can find my help useful and beneficial for them. Because of them, I learnt and experience many things from a working environment.

6 DESCRIPTION OF TASK ASSIGNED

6.1 Preparation of salt spray electrolyte

The salt solution is used to imitate sea water for corrosion testing. For salt spray test, the electrolyte prepared with 5% by mass of sodium chloride (NaCl) in 95% of Di Water which means 250g of NaCL in 5 litre of water. There is a total of two salt spray machine and each of them needed to be refilled according to the standard test running in every two days in order to maintain a full tank.

6.2 Preparation of 20% of sulphuric acid solution

The 20% sulphuric acid solution is used to analyse the concentration of Hal S-23 (anodizing Additive). The 20 % sulphuric acid solution is prepared as follows:

1. Add 200 ml Di water in 1000 ml volumetric flask
2. Add 200ml of 98% sulphuric acid into the 1000 ml volumetric flask slowly.
3. Add another 600 ml of di water to the flask and close the volumetric flask with sopper and wait the acid solution to cold down before it can be used.

6.3 Jigging

Jigging is the first step for plating process. For this step the steel part (steel spool / hexport part) is jigged into it own designated jig. The non- conformance part is saperated . After jigging, the part is taken for plating process at plating line. Each jig carries different number of steel part. For example the steel spool mother jig can carries about 3300 steel spool. However the jig must be stripped in HNO_3 before it can be used for jigging.

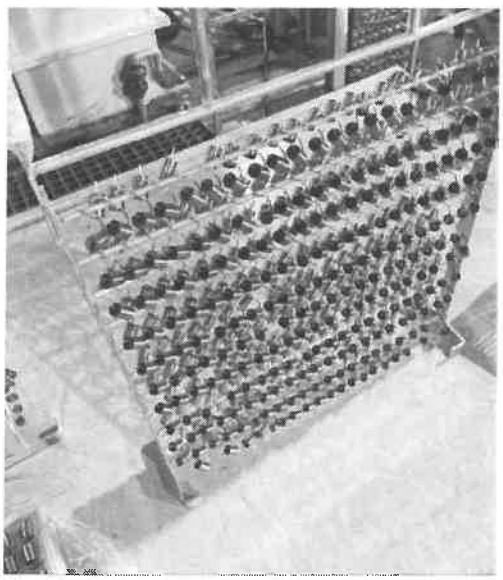


Figure 6: Steel spool on the plating jig

6.4 Analysis of the nickel content in plating solution

Nickel is one of the important elements in plating process. The nickel concentration must be maintained at 5g/l so that steel part can be plated perfectly. The plating solution sample is taken from each plating tank .The analysis is conducted in every 4 hours. The analysis is done as follow:

Nickel analysis procedure

1. Pipette 5ml sample in the conical flask
2. Add 100ml Di water
3. Add 10ml of 25% Ammonia solution
4. Add 1 scoop of murexide indicator
5. Titrate with 0.1ml/EDTA (Ethylenediaminetetraacetic acid) until the solution turn from yellow to purple endpoint

If the concentration of nickel in solution is below than 5g/l the plating solution must be top-up in the plating tank. The pH also need to be maintained at 4.5. If the pH is below than 4.5 the pH adjustment is done by using ammonia. Each ammonia and plating solution that value that has been added in to the plating tank is recorded at plating line's logbook.

Nickel concentration (g/l) = ml of 0.1 mol EDTA x 1.17

Replenish (kg) = (control nickel value – current nickel concentration) x tank volume (L) /1000

6.5 Analysis of sodium hypophosphite for electroless nickel plating solution.

Theory explanation (WFH Task)

Sodium hypophosphite ($NaPO_2H_2$) is mainly used for electroless nickel plating solution as reducing agent. Sodium hypophosphite is important to reduce nickel ion in plating solution to metallic nickel substrate on the surface of the product. Equation below shows how the hypophosphite work for taking the dissolve nickel salt and depositing on the surface of the part.

$$Ni^{2+} + H_2PO_2^- + H_2O \rightarrow Ni\ (s) + H_2PO_3^- + 2H^+$$

$$H_2PO_2^- + H_2O \rightarrow H_2PO_3^- + H_2\ (g)$$

Some hypophosphite is also deposited on the surface of the product as well. Both nickel and hypophosphite are consumed during the plating process.

$$2Ni^{2+} + 8H_2PO^-_2 + 2H_2O \rightarrow 2Ni_0\ (s) + 6H_2PO^-_3 + 2H^+ + 2P\ (s) + 3H_2\ (g)$$

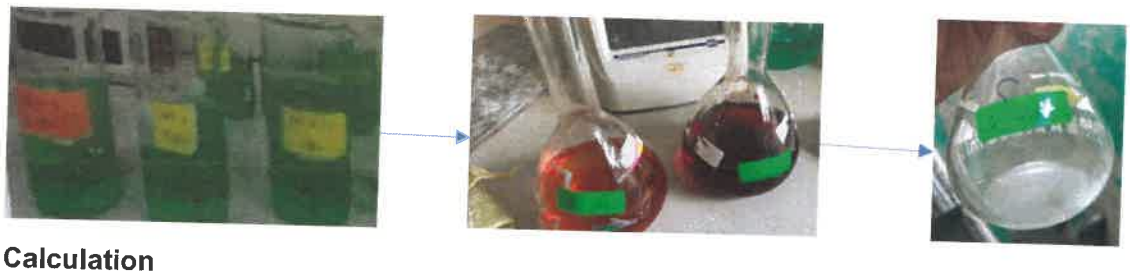
Based on the equation above, each gram of nickel metal plated onto a part will consume about 4 grams of hypophosphite. The ratio between the nickel concentration and phosphorus is important to maintain the predictable deposition rate. The concentration of the hypophosphite that need to be maintained for EN solution is between 25 g/l-32 g/l.

On-site task

In order to measure the concentration of the hypophosphite for EN solution, an analysis should be conducted. This analysis is conducted every day. The sample is taken around 10 am from the electroless nickel plating line. The concentration of the sodium hypophosphite is recorded in excel. Titration sodium thiosulphate is the most common way to measure the hypophosphite concentration.

Sodium thiosulphate titration procedure.

1. Pipette 5 ml sample of EN plating solution into 250ml volumetric flask.
2. Add 25 ml of 50% hydrochloric acid
3. Add 50 ml of Di water
4. Add 50 ml of 01.N iodine solution with a pipette.
5. Close the volumetric flask with stopper and store immediately under dark condition for 1 hour.
6. After 1 hour, titrate the solution with 0.1N sodium Thiosulfate to colourless endpoint.



Calculation

Concentration of sodium hypophosphite (g/l)

= (50 ml – ml of 0.1 Sodium thiosulphate titrated) x 1.08

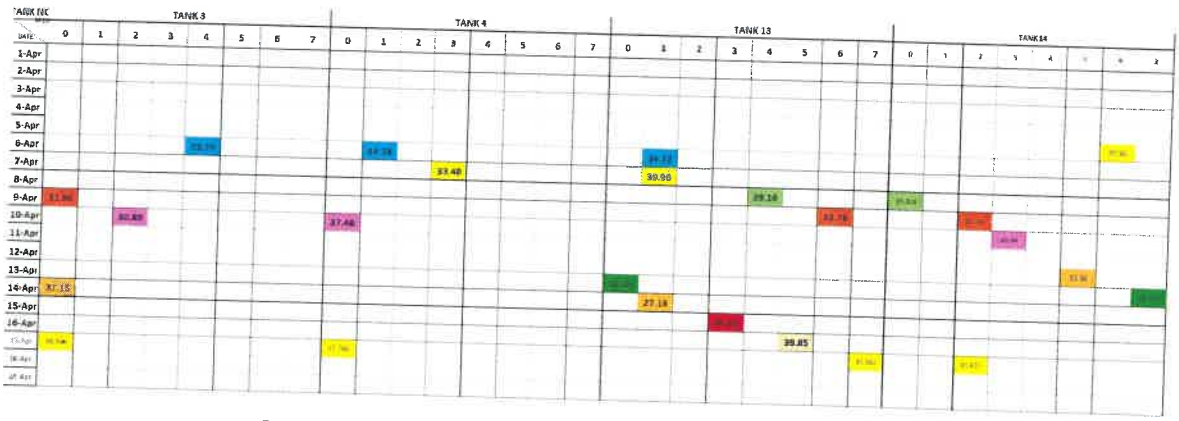


Figure 7: sodium hypophosphite concentration data

6.6 Analysis of aluminate- anodizing bath

Theory explanation (WFH Task)

Chemical analysis for anodizing bath is important for the performance of anodizing process. One of the primary components of the anodizing process is dissolve aluminium. The ideal concentration of dissolve aluminium is below than 15g/l. If the aluminium content is too low, the anodizing efficiency will go down due to the higher energy consumption needed to achieve the desired thickness.

On-site task

To measure the aluminate content in anodizing bath, an analysis of aluminate is conducted. This analysis is conducted twice a week which is on Monday and Friday. The concentration data of aluminate is recorded in excel.

Analysis of aluminate procedure

1. Take 50 ml of anodizing bah solution into 25 ml flask. Then add 200 ml of Di water.
2. From the 250 ml diluted bath solution, take 25 ml of the solution and place it in new flask.
3. Add 5 drop of phenolphthalein indicator.
4. Titrate with 1N sodium hydroxide until the colour change from clear to pale pink. Sodium hydroxide titrant is denoted as 'A'
5. Add 5 ml of sodium hydroxide until the colour change from pale pink to red. Added value is denoted as 'B'
6. Titrate with 1n nitric acid until the colour change form red to colourless.

Calculation

Concentration of aluminate (g/l) = (4.5 x A) - (1.8 x (B – C))

ALUMINATE (Control: <15g/l)					
DATE		TANK I	TANK 2	TANK 3	TANK 4
24/5/2021	Factor	4.50	4.50	4.50	4.50
	Factor	1.80	1.80	1.80	1.80
	Titration (NaOH)	1.15	1.25	1.00	1.40
	Titration (NaOH)	6.15	6.25	6.00	6.40
	Titration (HNO3)	3.00	2.90	1.70	1.50
	RESULT	**0.50**	**0.41**	**3.24**	**2.52**

ALUMINATE (Control: <15g/l)					
DATE		TANK I	TANK 2	TANK 3	TANK 4
21/5/2021	Factor	4.50	4.50	4.50	4.50
	Factor	1.80	1.80	1.80	1.80
	Titration (NaOH)	1.00	1.10	1.00	1.50
	Titration (NaOH)	6.00	6.10	6.00	6.50
	Titration (HNO3)	2.00	2.20	1.90	1.50
	RESULT	**2.70**	**2.07**	**2.88**	**2.25**

Figure 8: aluminate concentration data

6.7 Analysis of HAL S-23 – Anodizing bath

Theory explanation (WFH Task)

HAL S-23 is an additive that added in anodizing bath. This additive prevents the aluminium product from burning during the anodizing process. Low tendency of burning gives high quality and even uniform oxide form at high current voltage which can decreasing the anodizing time and can increase the production rate. This additive also can give the aluminium parts become harder, more dense, and consistent coating. In order to maintain the good property of the product, this additive need to be control during the process. The right range of concentration for this additive for this process is 20 g/l.

Theory explanation (WFH Task)

An analysis is conducted to measure the additive concentration and measure how much replenishment needed for the process. This analysis is conducted twice a week and the concentration data is recorded in excel each time the analysis is conducted.

HAL S – 23 analysis procedure (Titration of $KMnO_4$)

1. Take 10ml of bath solution and place in a flask. Then add 90 ml of Di water in the same flask.
2. From the diluted solution, take 10ml of the sample and place in a new flask.
3. Add 50ml Di water and 40ml of 20% sulphuric acid
4. Heat the solution up to 60°C-70°C
5. Titrate with 0.1n potassium permanganate (KMnO4) slowly drop by drop while swirling until the colour changes from colourless to permanent light pink.

Calculation

Concentration of HAL S-23 (g/l) = ml of 0.1N potassium permanganate x 6.1

Replenishment

Replenish (Kg) = (20 – Concentration of HAL S) x Tank volume/100

Tank volume = 525 litre

HALS-23 (Control : 20 g/l)

DATE		TANK 1	TANK 2	TANK 3	TANK 4
12/4/2021	Factor	6.10	6.10	6.10	6.10
	Control	20.00	20.00	20.00	20.00
	Tank Volume	525.00	525.00	525.00	525.00
	Titration ($KMnO_4$)	4.00	4.00	6.60	3.00
	Result	24.40	24.40	39.56	18.30
	Top-up	-	-	-	**0.89**
16/4/2021	Factor	6.10	6.10	6.10	6.10
	Control	20.00	20.00	20.00	20.00
	Tank Volume	525.00	525.00	525.00	525.00
	Titration ($KMnO_4$)	3.20	3.00	4.00	3.80
	Result	19.52	18.30	24.40	23.18
	Top-up	**0.25**	**0.89**	-	-

Figure 9: HALS-23 concentration data

6.8 Analysis of sulphuric acid-anodizing bath

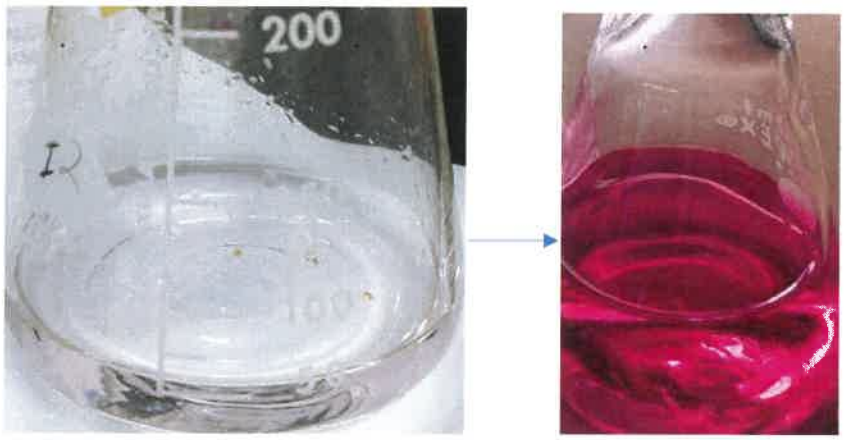
Theory explanation (WFH Task)

Sulphuric acid anodizing process is the common process for anodizing. Sulphuric acid content in anodizing bath is important to ensure the ideal range of formation of oxide layer on the product during the process. The ideal concentration of sulphuric acid for dis process is 176 g/l. To accurately quantify the amount of acid in a bath, it is necessary to test a sample of the bath by titration. The titration is done as follows:

On-site task

Analysis of sulphuric acid procedure

1. Pipette 2ml sample and put into conical flask.
2. Add until the colour change from colourless to red.
3. dd 100 ml Di water
4. Add 1-2 gm of potassium fluoride.
5. Add 5 drops of phenolphthalein indicator.
6. Titrate with 1N sodium until the colour changes from colourless to red.



Calculation

Concentration of sulphuric acid (g/l) = ml of sodium hydroxide x 24.5

Replenishment

Replenish (litre) = (176 – concentration of acid) x tank volume / 1000

Tank volume = 525 litre

6.9 Analysis of sodium hydroxide (NaOH) - etching bath

Theory explanation (WFH Task)

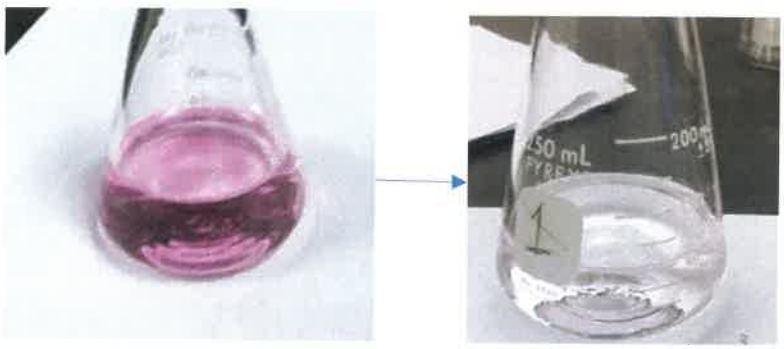
Etching is one of step that takes place at the pre-treatment segment during anodizing process. During at etching step, small amount of aluminium is removed when the parts submersed in the sodium hydroxide at a specific time. Etching is important to provide a clean surface by removing existing oxide layer and give good new formation of oxide layer on the aluminium surface. Besides that, etching also remove aluminium metal uniformly and roughens the surface of the metal to provide uniform matte finish. This process also is important remove any remaining, grease, oil and other contaminant on the aluminium surface so that high quality of oxide layer can be form on the aluminium surface.

On-site task

The concentration of NaOH that need to be control for this step is 53 g/l. To measure the concentration of NaOH and analysis is done as follows:

Sodium hydroxide analysis procedure

1. Pipette 10ml sample and put in conical flaks
2. Add 100ml of DI water
3. Add 5 drops of phenolphthalein indicator
4. Titrate with 1n hydrochloric acid until colour changes from pink to colourless.



Calculation

Concentration of NaOH = ml of 1N hydrochloric acid x 4

Replenishment

Replenishment should be done if the concentration is bellow that 53 g/l.

Replenishment (KG) = (53 – concentration of NaOH) x Tanak volume / 100

Tank volume = 243 litre

6.10 Analysis of nitric acid (HNO_3) - desmutting bath

Theory explanation (WFH Task)

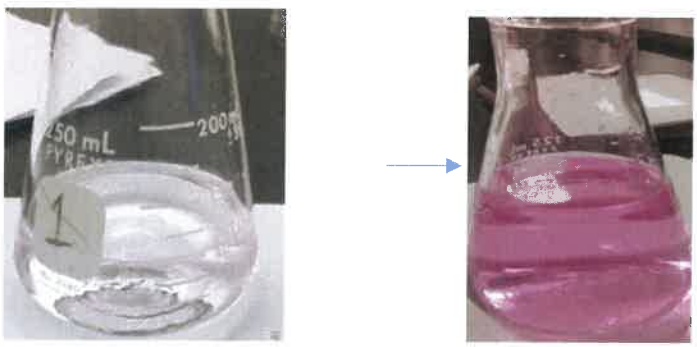
After etching step, the aluminium part will undergo desmutting step in the pre- treatment segment. During etching step, NaOH react with the aluminium and generate hydrogen, complex oxide, and hydroxide aluminium. Some of these products including intermatellic compound and other metal are insoluble in etch bath. These contaminants will remain on the surface of the part after etching step. These contaminants can be easily removed through desmutting step. Nitric acid is used as the desmutting bath for anodizing process.

On-site task

The concentration of the nitric acid that need to be maintain for this step is 50 g/l. To measure the concentration of HNO_3 and analysis is done as follows:

Analysis of nitric acid procedure

1. Piette 2ml sample into the flask
2. Add 100ml Di water
3. Add 5ml of phenolphthalein indicator
4. Titrate with 1N of sodium hydroxide (NaOH) until the colour change from colourless to pink



Calculation

Concentration of HNO_3 = ml of 1N NaOH x 3.125

Replenishment

Replenishment should be done if the concentration is bellow that 50 g/l.

Replenishment (L) = (50 – concentration of HNO_3) x Tank volume / 100

Tank volume = 243 litre

6.11 Teflon content in EN-PTFE analysis

Theory explanation (WFH Task)

Teflon is a synthetic polymer which contain fluorine and carbon that called as polytetrafluoroethylene. Nickel Teflon plating is used in automotive industries to provide component with high lubricity that other kind of plating process. Low Teflon content in the solution will affect the final product. Low Teflon content will cause the plated component to become high resistant and not suitable for daily life uses. The Teflon concentration in the plating solution must be maintained at < 6g/l. The teflon part must be covered about 60% to ensure the quality of the component. To measure the content of teflon, and analysis is conducted as follows.

On-site task

Teflon content analysis procedure (Teflon content on part).

1. Clean a paled part using clean cloth and measure the weigh of the part
2. Strip the plated pard using nitric acid for 15 min
3. Rinse the pated part with DI water, and measure the part again
4. Dilute the nitric acid that has been used for stripping with 200 ml of DI water and vacuum filter the diluted acid using filter paper.
5. Weigh the filter paper after the filter dry

Weight of Teflon calculation

1. Weight of deposited (g) = weight of plated part - weight of stripped part
2. Weight of teflon (g) = weight of filter after vacuum filter (g) – Weight of clean filter paper.
3. Weight % of teflon = (Weight of teflon (g) / weight of deposited (g)) x 100
4. Volume of teflon cm^3 = weight of teflon (g)/ 2.3
5. Weight of Ni-P (g) = weight of deposited (g) – weight of teflon (g)
6. Volume of Ni -P = weight of Ni- p (g) / 7.9
7. Volume of % teflon = volume of teflon cm^3 / volume of teflon cm^3 + volume of Ni-P cm^3

Teflon content on solution analysis procedure

1. Add 50 ml of Teflon plating solution in a beaker
2. Add 150ml of Di water in the same beaker.

3. Filter the diluted solution and let it dry.
4. Weigh the filter after filter dry.

Teflon Content in Deposit

		Parts (Deposit)			Filter (Teflon)			Calculation of wt% Teflon	Volume of Teflon	gram of Ni-P,	volume of Ni-P	Calculation of volume % of Teflon
Date	TIME	Weight before strip (g)	Weight after strip (g)	Weight of deposit, A (g)	Weight before Strip (g)	Weight after Strip (g)	Weight of teflon, B (g)	%Teflon by weight (<60%) (B/A)	C=(B/2.2) (cm3)	D=A-B (g)	E=D/7.9 (cm3)	% by volume (< 60%) F=[100*C]/(D+E)]
20/4/2021	9.00am	10.270	10.262	0.007	0.921	0.922	0.0020	27.778	0.001	0.005	0.001	56.92
22/4/2021	9.00am	10.271	10.257	0.014	0.892	0.897	0.0055	39.568	0.002	0.008	0.001	69.22
23/4/2021	9.00am	10.268	10.255	0.013	0.884	0.888	0.0045	34.351	0.002	0.009	0.001	64.25
24/4/2021	9.00am	10.256	10.240	0.016	0.903	0.908	0.0052	32.099	0.002	0.011	0.001	61.39
26/4/2021	9.00am	10.274	10.254	0.019	0.887	0.895	0.0074	38.144	0.003	0.012	0.002	67.93
27/4/2021	9.00am	10.275	10.233	0.042	0.886	0.899	0.0123	30.476	0.006	0.029	0.004	60.09

Figure 10: Teflon content deposited data

Teflon Content in Solution

			Filter			Result		
Date	MTO	Time Sample Collected	Weight before Strip (W1) (g)	Weight after Strip (W2) (g)	Weight of Teflon Powder (ΔW) (g)	106.333 = Bath Control range (<6 g/l)	Checked By	Remarks
15/4/2021	2.90	9.00am	0.882	1.130	0.248	4.959	Amirul	
22/4/2021	0.50	9.00am	0.899	1.121	0.222	4.444	Amirul	
23/4/2021	1.73	9.00am	0.883	1.178	0.295	5.862	Amirul	
24/4/2021	0.96	9.00am	0.882	1.081	0.199	3.973	Amirul	
26/4/2021	0.00	9.00am	0.897	1.192	0.295	5.894	Amirul	
27/4/2021	1.68	9.00am	0.884	1.241	0.357	7.138	Amirul	

Figure 11: Teflon content in solution data

7 MINI PROJECT

During mu internship, my supervisor assigned me a mini project about anodizing time setting. However due to the current Covid-19 situation, I required by my company to WFH, so the project that has been assigned for me cannot be done and replaced with the new project where I can done it from home. The project that has been assigned for me during WFH is case study about possible accident at workplace.

7.1 Possible accident at workplace case study (WFH task)

Accident may be defined as unplanned and uncontrolled events in which the action or reaction of an object, substance, person or radiation results in personal injury or the probability thereof. There are many possible accident that can be happen in workplace. These accident can impact the productivity of the worker.

Trips and slips

Some of possible accident that can be happen in workplace is trips and falls. This is the common issue that happen in any workplace. This problem happen due to several factor such as cause by obstructions in walkways, uneven surface, slippery surface due to the spills of liquid such as water, oil and grease. Most of the strips and falls cases is cause minor injury and even have no injury at all to the worker, there are some cases can lead to the serious injury and even lead to death.

Explosion

There are three types of explosions which are mechanical, nuclear, and chemical. One of the main causes of chemical explosions is flammable liquids. Flammable liquids are among the most common hazardous chemicals found in a laboratory and even in production area of a plant. This flammable liquid is easily emit flammable vapor to the surrounding. When this vapor mix with oxygen and come into contact with source of sparks, the flash fire accident can happen. This flash fire can create another accident which are explosion. Explosion can be happen when the there is generation of high pressure gas is the results of an exothermic reaction resulting from the ignition of chemical explosives or fuel gases. This explosion can cause many injury to the people who are nearby.

Chemical spill

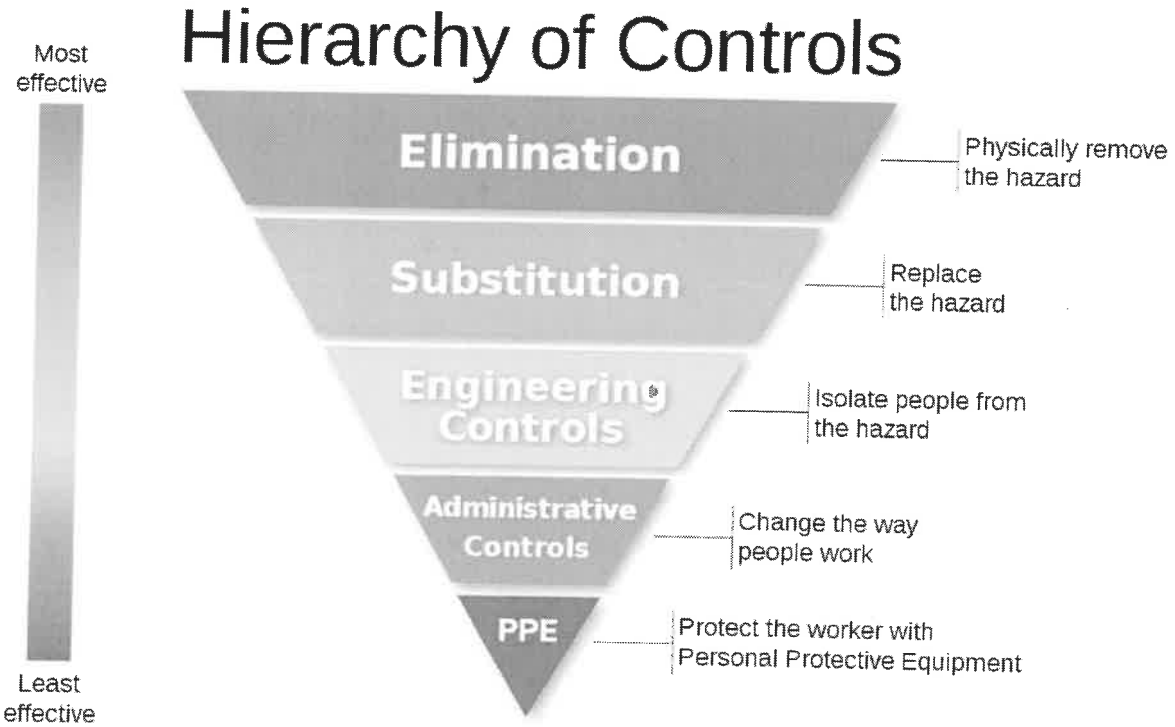
Chemical spills commonly result from the unsafe handling of chemicals, improper chemical storage, chemical storage tank ruptures, improper containers for chemical disposal, and

failure to dispose of chemicals in a timely manner. This accident can cause harm to human and even to the environment. The greater the concentration of toxic chemicals spill the more potential for life. The spilled chemical can affect human by causing skin irritation or burns or poisoning. Some of the acute effects when someone exposed to the spilled chemical are dizziness, skin irritation and throat irritation. This effect can be affected with 3 ways such as skin contact, inhalation, ingestion, and injection. The most common way when someone poisoned by chemicals are by skin contact, inhalation, and ingestion. The chemical spill also can effect the environment. The release of oil such as kerosene and even acid to the drainage system outside the factory/plant can kill under water life and even destroying their habitat. The chemical spill also can affect our clean water resources. These problems can cause critical resources in food chain.

Prevention needs to be taken to prevent accident at workplace.

To avoid accident happen in the future, Department of Occupational Safety and health (DOSH) has several measure of prevention from these kind of accidents.

1. The company or organization must conduct risk assessment (HIRARC) for the possible accident that can happen in workplace. The management should give safe working procedure for work that need to be done by worker.
2. The company or organization also can implement the hierarchy of control for these possible accident.



i) Elimination

Elimination is the first stage of the hierarchy pyramid. Its is the most effective control to avoid the accident from happen. For the slips and strips accident, most of the accident cause by slippery surface and cause by obstruction on walkways. These root cause can be easily eliminated by mopping or sweeping the liquid form floors and removing the obstacle form walkways. For the explosion accident, the store that keep the flammable liquid should be away from heat and sparks resources such as plugs and heater.

ii) Substitution

Substitution is the second stage of the pyramids. If the elimination cannot be used to eliminate the substitution should be implemented. For the chemical spill accident, the chemical should be stored the high quality carboy or drums. If the drums or carboy has leakage on it, the chemical inside need to be transferred to other drums or carboy.

iii) Engineering control.

Engineering control is the s mid-effective control. Some of the slips and trips cases cause by uneven surface at workplace. In order to eliminate the hazard concrete lifting can be done that area. This can reduce the accident possibility from happen at workplace. For the explosion accident, the store that keep the flammable chemical need automatic fire extinguisher system. This system can put down the fire quickly and lower the risk of explosion. For the chemical spill accident, the spill chemical should be confined to a small area by using absorbent pad to absorb the spilled chemicals.

iv) Administrative control

Administrative control the least effective control. The company or organization can do the supervision regarding the safety at workplace. The safety department can propose the proper ways that can be implemented to overcome these accident from happening. Besides that, production department should do housekeeping regularly. The flammable substances should be label and stored away from the production area to prevent unwanted accident especially explosion.

v) Personal protective equipment (PPE)

PPE is the least effective control and the last stage in the hierarchy pyramid. When the hazard can be eliminated by using elimination, substitution, engineering control and administrative control the PPE should be used. The worker must wear PPE especially in production area to avoid accident from happen.

8 CONCLUSION AND RECOMMENDATION

During these 17 weeks of internship, student managed gain fresh information and valuable experiences. Synturn (M) Sdn. Bhd is well-maintained company which is suitable for interns to begin learning on work culture that related to our course. Plating process is one of the process where it is not thought in my university course. From this internship, I managed to gain much knowledge related to chemical engineering especially in the plating process. I also gained much knowledge on safety precaution and hazards as to make sure those are taken seriously in any task operation.

This internship helped came to realise on the importance of time management. Unlike studying in college, some of the assignment or project is done in group. But the in real working environment there are to much differences. Real working environment give me is more draining physically and mentally compared to studying. In workplace, all the job need to be done on-time independently due to the I am the only one intern in this department. This internship thought myself to built confidence and managing time properly at the same time. However, thanks to this internship, I can improved myself and dealing with new people that has different characters and behaviours aside of become more independent and having good time management skill. In conclusion, the host company and especially for interns as the quality and quantity of experience and knowledge gained are very useful and applicable for student future demand.

9 APPENDICES

Figure 12: Aluminium spool during etching

Figure 13: Electroclean

Figure 14: Electroless nickel plating line

Figure 15: Teflon/pure zinc plating line (right)

Figure 16: Carbon treatment (Teflon plating line) (offline tank)