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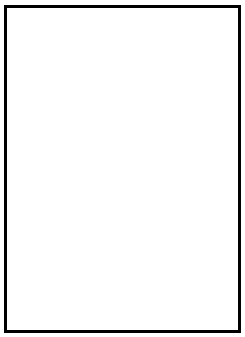


Dr. Muna K. Abbass
Dept. of production Engineering and Metallurgy, University of Technology
Email:mukeab2005@yahoo.com

Effect of Rare Earth Oxides (Y_2O_3, Nd_2O_3) on Oxidation Kinetics of Al-Li base alloy

Muna K. Abbas; Assist Prof.

Abstract:

The oxidation of Al-Li base alloy containing small amounts of rare earth (RE) oxides such as Y2O3 and Nd2O3 particles has been studied at temperatures between 300°Cand 550°C. The lithium is selectively oxidized in Al-Li alloys and the parabolic rate constants for the growth of the resulting oxides layer Li2O, LiAl5O8, Li2CO3 and Li5AlO4 are about an order of magnitude higher than those for growth of oxides on alloy (Al-Li) with RE oxides. Alloys used in this study were prepared by melting and casting in a permanent steel mould under controlled atmosphere.

It was found that 0.2%Y2O3 containing alloys possess the lowest oxidation rate and show great improvements in oxidation resistance compared to the base alloy.

Oxides found on base alloy are subjected to cracking and spalling during thermal shock at high temperature i.e. 500°Cand 550°C. Identification of oxidation kinetics was carried out by using weight gain measurements while scanning electron microscopy (SEM) and x-ray diffraction analysis were used for microstructural morphologies and phase identification of the oxide scales. The weight gain measurement results suggest that the oxidation kinetic of all studied alloys follows the parabolic law in most experimental tests under the different temperatures except at 300°C oxidation kinetic follows almost a logarithmic rate law.

Keywords: *Material, metal.*

1. Introduction.

Al-Li alloys offer attractive combination of properties for an extensive use in aircraft structures, reducing the density and increasing other properties like stiffness, fatigue resistance. These properties could already lead structural weight reduction of up to 15% on commercial airliners [1-3]. However these alloys undergo severe oxidation at high temperatures approximately an order of magnitude higher than the Li-free Al-base alloys. This tendency creates serious problems during high temperatures processing such as solution heat treatment , homogenization ,forming and aging [4-6].

Procedures for minimizing oxidation and lithium depletion during processing of Al-Li alloys are discussed elsewhere. Some workers Bakri et al, 1992[7] and Haidary et al, 2000 [8] also reported those trace element additions of (Y, Ge, Te) known to inhibit oxidation in certain Al-alloys. The rare earth element (REE) is now well known to improve the high temperature oxidation of stainless steel. Many authors have proposed theories about this beneficial effect [1-4]. The use of RE oxide coating has the advantage of not affecting adversely the mechanical properties of the alloy and it has also the potential of being used on surfaces of metallic components exposed to high temperature oxidizing environments [9,10] due to their excellent oxidation resistance and improve the resistance to scale spallation. The RE elements can be added to heat resistant alloys either in elemental form or as oxide dispersion [10, 11] .The RE can also be introduced into the surface by ion implantation

techniques or applied superficially by a variety of techniques.

In this research the RE oxides Nd2O3 (0.2%) and Y2O3 (0.2%) introduced into the base alloy (Al-Li-Cu-Mg) by a casting method using mechanical stirring to disperse Y2O3 and Nd2O3 particles in the molten base alloy and pouring the melt in steel molds. The present paper is concerned with the effect of RE oxides Nd2O3 and Y2O3 on the oxidation behavior and oxidation rate constant (Kp) of a solution hardened alloy (8090) at temperatures (300-550)°C.

2. Experimental procedures

Alloys were prepared by melting and pouring the melt in a permanent steel mold under controlled atmosphere by passing argon gas through an orifice in the cover of graphite crucible where the meting occurs and the RE oxides of Nd2O3 and Y2O3 (0.2wt% for each one)with size distribution of (3-10)µm were added and dispersed in matrix of base alloy A(Al-2.4% Li-1.2% Cu-1.0% Mg- 0.15%Zr),and obtained alloy B and C which contain 0.2% Nd2O3 and 0.2% Y2O3 respectively . The prepared alloys were homogenized in dry air at 530°C for 18hr followed by hot rolling up to 50% reduction .The solution heat treatment has been done at 530°C for an hour and water quenching then aging at 190°C for 10hr for all specimens. The chemical composition analysis of the base alloy A (Al-Li-Cu-Mg) was carried out by using spectral analysis device of spectrometer type ARL. Results of the analysis with the standard value for each element and density are shown in Table (1).

Table (1): Analysis chemical composition and density of the basealloy A(Al-Li-Cu-Mg)

Element (wt%)	Li	Cu	Mg	Zr	Ti	Fe	Si	Rem	ρ (g/cm^3)
Measured value	2.4	1.2	1.0	0.15	0.03	0.03	0.03	Al	2.561
Standard value(8090)	2.2-2.7	1.0-1.(	0.6-1.3	0.04-0.16	0-0.10	0-0.30	0-0.2	Al	2.554

Oxidation specimens were cut from ingot after homogenization as discs in dimensions of 15mm diameter and (2-2.5)mm thickness. These specimens were grounded with water by using emery paper of SiC with different grits(220, 320 ,500 and 1000).Polishing process was done by using diamond paste (grade 1µm) with special polishing cloth and lubricant. They were cleaned with water and alcohol and dried with hot air. The specimens were oxidized at temperature range of 300°C to 550°C in static air at atmospheric pressure in a vertical tube furnace with uniform hot zone. The temperature of the hot zone is controlled by thermocouple type K. The oxidation kinetics were determined by the weight gain method with a microbalance of an accuracy of 0.1mg ,where the specimen was placed into the hot furnace after reaching the required temperature ,each specimen was hung using pt-wire.

Upon completion of the kinetic measurements the oxidized specimens were examined optically to evaluate their surfaces topography .Standard x-ray diffraction techniques were employed for phase identification of the alloy and the oxidation products, using Philips 1830 x-ray diffractometer with Cu.Kα radiation (1.547A˚).

3-Results and Discussion

3-1 Microstructure of prepared alloys

All alloys were fabricated by a method of melt stirred composing and pouring the melt in steel mould. Figure (1) shows the microstructure of prepared alloys (A, B and C) after casting and deformation and solution heat treatment respectively. The micrographs of the base alloy A (Al-Li-Cu-Mg) ,alloy B and alloy C with the RE oxides Nd2O3 and Y2O3 particles uniformly distributed in the matrix of alloy.

3-2 Oxidation behavior of alloy (A)

Isothermal oxidation measurements revealed weight gain increases with time. At temperature 300°C, shown in Figure (2) indicates that the weight gain (ΔW/A) increases until reaching certain values, it becomes roughly constant value of (ΔW/A) at (60hr). This is due to formation of protective oxide layer of alumina (Al2O3) on a base alloy (Al-Li-Cu-Mg).

Previous studies [3 ,4] with Al –Li base alloy have shown that during the initial period of oxidation both Li2O and Li2CO3 are formed on the surfaces of specimen and as oxidation continues the oxide layers become continuous separating the Al2O3 from the alloy. The variation of the shapes of the

weight gain change vs time curves for alloyA are also due to the increase amount of oxide layers that are formed on the surface of these specimens. Show Figures (3, 4, and 5).

The results obtained for alloy(A) show that the oxidation kinetic of this alloy is controlled by interdiffusion of lithium through Al_2O_3 scale, and the oxide /gas interface reaction which involves the formation of different oxides Li_2CO_3 scale , γ-$LiAlO_2$, $LiAl_5O_8$ and α-Li_5AlO_4 in addition to the Al_2O_3 scale as shown in x-ray diffraction analysis (see appendixes A & B).

Data for oxidation of an alloy (A) (Al-Li-Cu-Mg) at 550°C are also included for comparison and it is obvious that the oxidation rate of alloy A in terms of weight gain is greater than that for RE-containing alloys at this temperature. Similar results were obtained at other temperatures within the interval of oxidation of (60hr).

The oxidation kinetics for alloy (A) obey a parabolic law (relationship) at the weight gain (ΔW/A) measurement. However such a oxidation rate law was approached for specimens oxidized at 400°C, 500°C and 550°C after (60hr) of oxidation time.

3.3 Oxidation behavior of alloys (B, C)

Comparison of results obtained for the oxidation of an alloy (A) (Al-Li-Cu-Mg) to those alloys containing 0.2%Nd_2O_3 and 0.2%Y_2O_3 (alloy B and alloyC) respectively. It was found that dispersion of RE oxide in matrix of base alloy (Al-Li-Cu-Mg) improves the oxidation resistance and shown that the weight gain (ΔW/A) of alloy (C) was lower than that of other alloy (A) and alloy (B) at all oxidation temperatures as shown in Figures (2,3,4 and 5). This is due to the role of Y_2O_3 particles in reducing oxidation rate in the base alloy (A) and decreasing growth rate of Li_2O scale and other oxide layers ,show Fig(6). Since Y_2O_3 atoms improved adhesion between scale and substrate alloy by two mechanisms [10,13] .The oxide scales formed on alloy (C) are also thinner than the scales that are formed on alloys with similar lithium content but which do not contain dispersed yttria (Y_2O_3) particles Oxidation behavior of alloy (B) was similar to alloy(C) at all temperatures (300-550)°C, show Figures(7 and 8)..

X-ray analysis of the oxide scale on the alloy (B) and (C) indicated that Nd_2O_3 and Y_2O_3 respectively were always present in external scales. Since the external scales did not spall and crack significantly during thermal shock form high temperature 550°C and 500°C after oxidation time (50hr). In case of alloy(C), the oxide layer remains sound and unaffected by thermal shock. This could be attributed to Nd_2O_3 and Y_2O_3 atoms effect in reducing vacancies at the oxide /metal interface and modify the diffusivity and solubility of alloying element in alloy [13,14].

The weight gain result for alloy (B) containing 0.2%Nd_2O_3 was greater than that of alloy (C) containing 0.2%Y_2O_3 for up to 60 hr of oxidation periods but less than that of alloy (A). This is due to the role of Nd_2O_3 particles inhibit growth of oxide scales at high temperatures and improvements of oxides plasticity and adhesitivity. These results agree with those of other workers Chevalier et at, 1998[14]

3.4 Effect of Thermal Shock

The effect of thermal shocks on the mechanical integrating of scale was studied. The specimens were subjected to thermal shock by quenching it rapidly from the oxidation temperature to room temperature and then was returned to furnace and the weight was recorded again, the loss in weight indicates scale breakdown (spalling), Oxides formed on alloy(A) crack and spall largely when subjected to thermal shock after 50hr of oxidation at 550°C as shown in Figure(9).

In case of alloy(B)(Nd_2O_3-containing alloy) the oxides also cracked and spalled during the thermal shock after 50hr of oxidation at 550°C but the effect of thermal shock was less severe than that of alloyA as shown in Figure(10).

In case of alloy(C) (Y_2O_3-containing alloy) the oxides layer remain sound and unaffected by thermal shocks as shown in Figure (11).

The spalling was not detected at lower temperature (300°Cand 400°C). This could be explained by the fact that the oxide layer was more adhesion and protective compared to that produced at (500°Cand 550°C). The RE oxides are also considered to act as preferential nucleation sites for Al_2O_3 formation. Entrapment of RE oxides within Al_2O_3 layer has been observed. The x-ray diffraction analysis showed that Nd_2O_3, Y_2O_3 particles were present in oxide scale on the alloyB and C respectively.

Proof of conclusion this has been observed and similar observations were presented by Papaiacovou and Hussey [15] for scale growth on ceria (CeO_2) coated on Fe-Cr alloys.

3-5Results of oxidation kinetics

Results of oxidation of base alloy (Al-Li) are given in terms of weight gain (ΔW/A) presented in kinetics curves ,show Figures(2,3,4 and 5). Weight gains were recorded for kinetic of oxidation in dry

air at temperature range (300°C-550°C) for up to 60hrs.

For the parabolic oxidation kinetics, the rate equation takes from:

(ΔW/A) = Kt 0.5	**1**

A plot of square weight gain (ΔW/A) vs time (t)gives a line, the slope of which is the parabolic rate constant (Kp) as the following equation:

(ΔW/A)2 = Kpt	**2**

To give Kp in units (mg2.cm-4.sec-1). The Kp for three alloys (A, B and C) at temperatures 400°C, 500°C and 550°C are calculated and the liner lines represent the squares curves fitting as shown in Figures (12, 13 and 14) . The parabolic oxidation rate constants (Kp) for alloys are listed in Table (2). The oxidation kinetics for alloy(A), alloy (B) and alloy(C) obey a parabolic law (relationship) at the weight gain (ΔW/A) measurements , however such oxidation rate law was approached for specimens oxidized at 400°C ,500°C and 550°C after (60 hr) of oxidation time.

From experimental data plot of Log Kp vs (1/T), an activation energy(Q) was calculated from least square fitting (R2=0.98) of the observed data in the temperatures range from 400°C to 550°C to be (169.86, 166.85 ,168.44) KJ/mol for alloys(A, B ,C) respectively as shown in Figure (15).

Kp that obeys an Arrhenius - type equation of the following [16]:

Kp = K0 exp(– Q/ RT)	**3**

where Kp is the parabolic oxidation rate , K0 is the pre- exponential value , Q is the activation energy , T is the temperature and R is the universal gas constant

[8.33 (J/ K)/mol)] or 1.987 cal /K /mol. A linear regression analysis of the equation (3) results in the following relationships for Kp as a function of temperature :

Kp = 4*10 7 exp(-20392/ T)	**4**

AlloyA

Kp = 1*107 exp(-20031/ T)	**5**

AlloyB

Kp = 5*106 exp(-20222/ T)	**6**

AlloyC

The weight gain (ΔW/A) data for each temperature test is plotted as shown in Figures (2,3, 4 and 5) as the evolution of the mass gain (ΔW/A) of the sample as a function of oxidation time. The initial kinetic is rapid but the rate of (ΔW/A) gradually decreases at longer times the kinetics can be described by examining the growth rate time constant or n-value which is found as the exponent in the following equation:

(ΔW/A) = K t ^{n}	**7**

Log (ΔW/A) = n log t + C_1	**8**

The slop of a log-log plot gives the n-value , the growth rate time constant which provides an indication of the mechanism controlling oxidation and C1 is a constant represent the intersect point of the curve with y-axis as shown in Figures (16, 17 and 18)

At 500°C, the n-value is about 0.5, i.e. parabolic behavior is found. Another

n-values are shown in the Table (2). When the value of (n) is greater or lower than 0.5 then oxidation kinetic does not fall in the simple parabolic behavior and this implies faster or lower oxidation rate .For example, for n > 0.5 it is an overparabolic , while for n < 0.5 there is underparabolic (sub – parabolic)[17] .Results have shown that the subparabolic may be found because of grain boundary (short circuits) mechanism [18]. Deviation from theoretical value of n = 0.5 can be explained by an oxide layer cracking ,leading to a sudden increase of the surface area in contact with oxygen and thus to an acceleration of the oxidation kinetics.

Table (2): Values of n-value and Kp

Alloy	Temperature °C	n- Values	Kp ($mg^2.cm^{-4}.s^{-1}$)
Alloy A	300	--	---
	400	0.426	2.40E-06
	500	0.547	1.97E-04
	550	0.425	5.02E-04
Alloy B	300	--	---
	400	0.326	1.10E-06
	500	0.549	1.06E-04
	550	0.407	1.94E-04
Alloy C	300	--	---
	400	0.437	4.00E-07
	500	0.498	2.74E-05
	550	0.529	8.44E-05

4. Conclusions

1-The oxidation kinetics for all investigated alloys did obey to the parabolic law at temperature 400C°, 500°C and 550°C expect at 300°C oxidation kinetic follows almost a logarithmic law.

2-The oxidation rate constant (kp) for alloys containing RE oxides (Y2O3 & Nd2O3) was lower than that of base alloy at all oxidation temperatures.

3-The Y2O3 and Nd2O3 particles dispersion in matrix of the base alloy (Al-Li) improve the oxidation resistance of this alloy at high temperatures (500°C and 550°C).

4-The presence of RE oxides in the base alloy (Al-Li) decreases the growth rate of LiO2 and Li2CO3 scales.

5-The Y2O3 and Nd2O3 particles improve the adherence of protective oxide even after extended periods of oxidation.

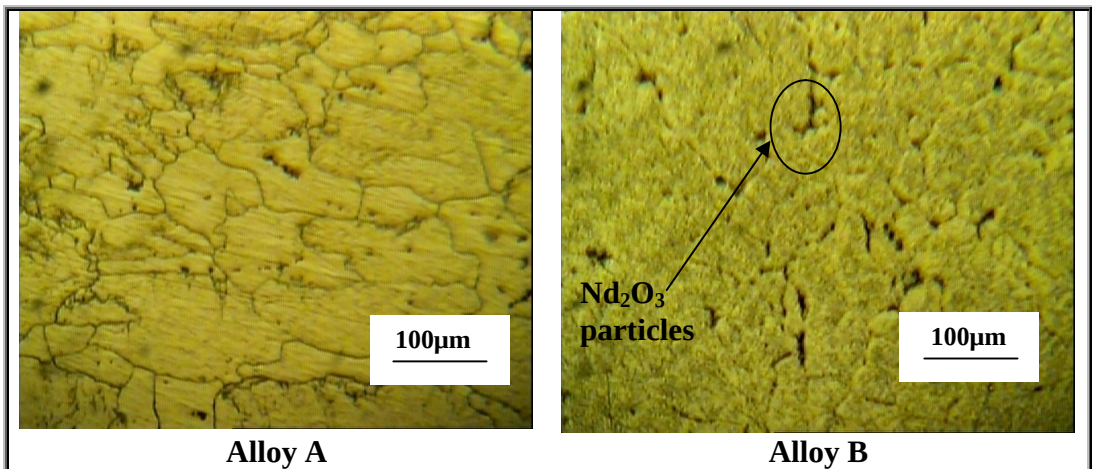
6-The RE atoms block Li-atoms diffusion along grain boundaries and consequently the Li-oxides on RE oxide containing specimens are considerably thinner.

7- X-ray diffraction analysis of the oxide scale of specimens shows the presence of Y2O3 and Nd2O3 particles in external scale and uniformly distributed in matrix of base alloy.

5. References:

1. Martin J. "Aluminum Lithium Alloys", Ann. Rev. Mat. Sci., Vol.18, 1989, PP.101-119.
2. Jaroslaw Mizera , Malgarzata Lewandowskq , Alexander V. korzikov , Krzysztof J. and Kurzydlowski, "Microstructure and Mechanical Properties of Binary AL-Li Alloys Processed by ECAE" ,Solid State Phenomena ,Vols.101-102 , 2005, PP.73-76.
3. Brue M .and Papazian J.M., "Elevated Temperature Oxidation of Al-Li Alloy", 3rd Int. Al-Li Conf. London,1986, PP.287-293.
4. Partridge P.G., "Oxidation of Al-Li Alloy in the Solid State", International Materials Reviews, Vol.35, No.1, 1990, PP.37-60.
5. Son k .k .Williams J.M., Chabalo J.M., Levi – Setti R. and Newbury D.C., "Role of Second Phase Particles in The Oxidation of Al-Li Alloys" , Oxid. Met., Vol.37, No.2 , 1992, PP.23-37.
6. Polymer I.J., "Light Alloys", Metallurgy of The Light Metal, 2nd Ed., Edward Arnold, A division of Hodder & Stoughton, 1989.
7. Barki A.W, Al-Haidary J.T. and Rozoki R.N., Eng.and Techn. J. Vol.11, No.8, 1992 , P72.
8. Al-Haidary J.T and Abbass M.K., "Effect of Ge ,Te and Y Additions on Oxidation and Properties of Al-Li alloy", Dirasat Journal Eng. Sci , No.1, 2000, Muharram University of Jordan ,PP.153-169.
9. Pint B.A., More K. L, Tortorelli P.F., Porter W.D. and Wright I.G. ,"Optimizing The Imperfect Oxidation Performance of Iron

Alumindes" ,Oak Ridge National Laboratory ,USA ,2003,www.Internet.
10. Fernandes S.M.C. and Romanathan L.V.," Rare Earth Oxide Coating to Decrease High Temperature Degradation of Chromia Forming Alloys" , Materials Research ,Vol.7, No.1, 2004, PP.1-5.
11. Giggins C.B.and Pettit F.S., "The Oxidation of TDNiC (Ni-20Cr-2Vol pct ThO2) Between 900C°and 1200C° ", Metallurgical Transaction ,Vol.4 ,1971, PP.1071-1078.
12. Muna K.Abbas, Ph.D.Thesis, "Effect of Trace Additions of Alloying Elements on Oxidation and Some Properties of Base Al-Li Alloy", University of Technology, Baghdad –Iraq, 1995.
13. Delauany D .and Huntz A.M. ,"Mechanisms of Adherence of Alumina Scale Developed During High Temperature Oxidation of Fe-Ni-Cr-Al-Y Alloys" , Journal of Mat. Sci., Vol.17, 1982, P2077.
14. Chevalier G., Bonnet J.G., Dufour P. and Larpin J.P., " The REE: Away to Improve The High Temperature Behavior of Stainless Steels ?", Surface and Coatings Technology" ,Vol.100-101,1998, PP.208-223.
15. Papaiacovou P. and Hussey R.J., Corrosion Sci., Vol.30, No.4/5,1990, P451 .
16. Denny A. Jones, "Principles and Prevention of Corrosion", 2nd Ed., Prentice Hall, Upper Saddle River, 1996.
17. Khalil Al-Hatab, "Effect of Environment on Oxidation Behavior of Inconel Alloy 600 ,Ph.D. Thesis, University of Technology ,Baghdad –Iraq ,2004
18. Panter J., Viguer J. and Andrieu E.," Microstructural Evolution of Alloy 600 during Dry Oxidation", Materials Science Forum, Vols.369-372, 2001, PP.141-148.



Alloy A **Alloy B**

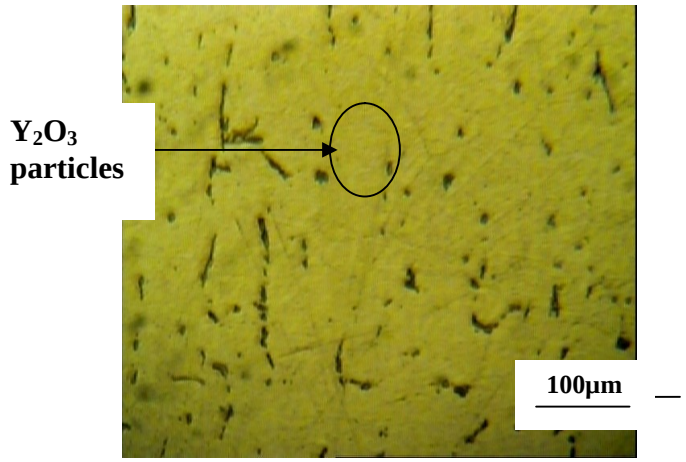


Figure (1) Microstructure of the prepared alloys after casting , deformation and solution heat treatment

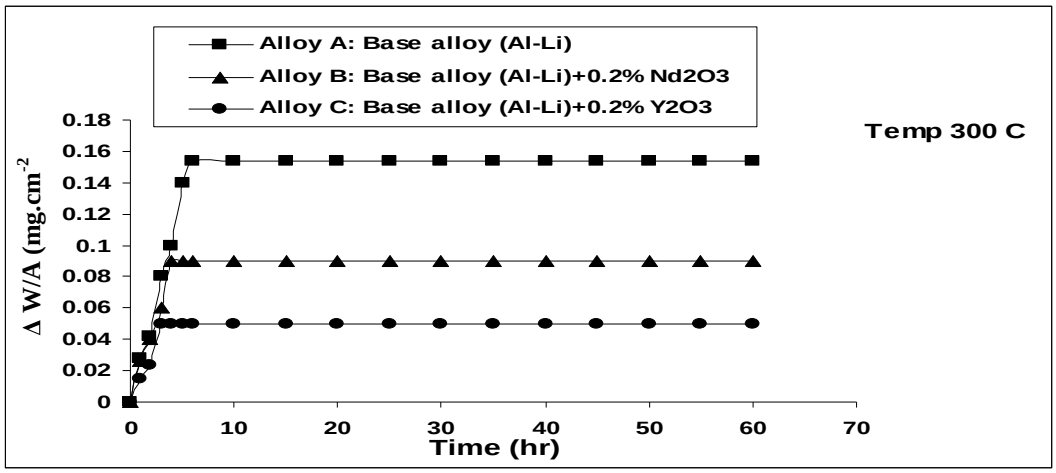


Figure (2) Weight gain/ unit area with time for oxidation of the alloys(A,B,C) at 300°C

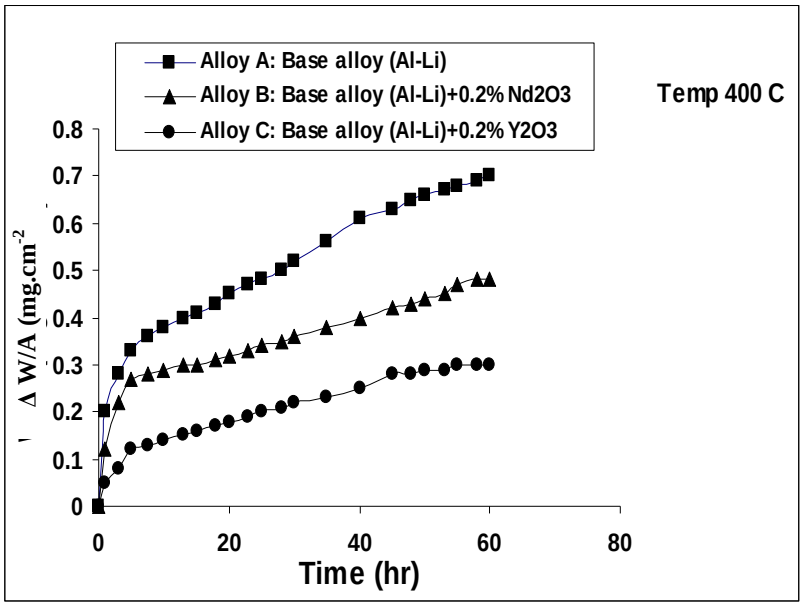


Figure (3) Weight oxidation of the alloys gain/ unit area with time for (A,B,C) at 400°C

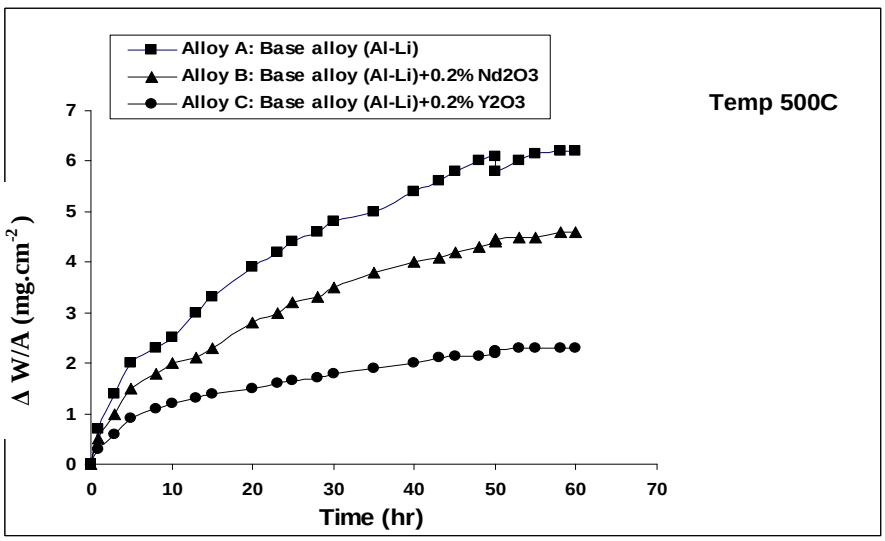


Figure (4) Weight gain/ unit area with time for oxidation of the alloys(A,B,C) at 500°C

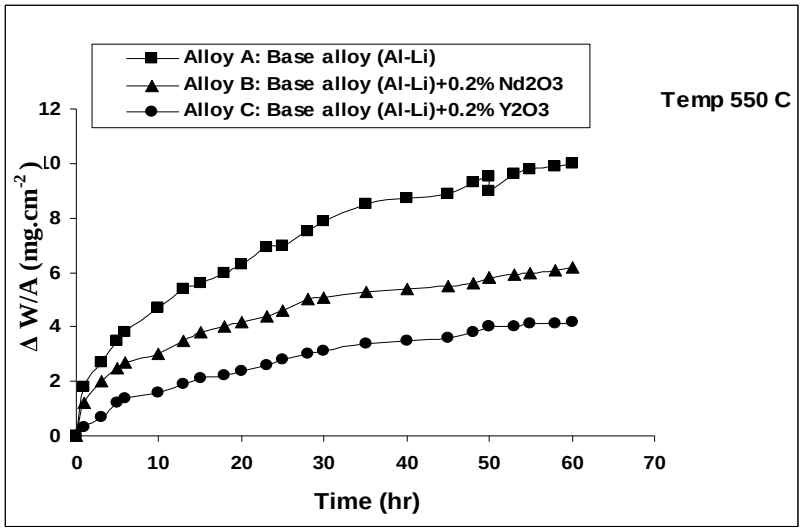


Figure (5) Weight gain/ unit area with time for oxidation of the alloys(A,B,C) at 550°C

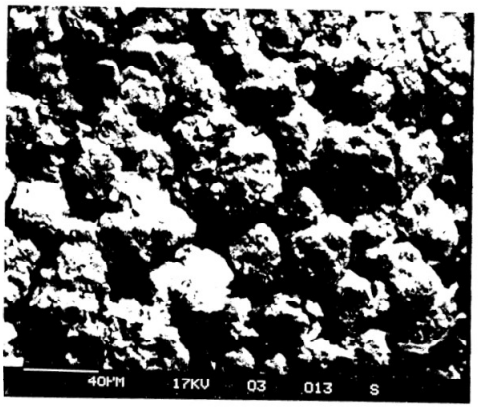


Figure (6) Morphology of growing oxide formed on alloy(A) after oxidation at 550°C

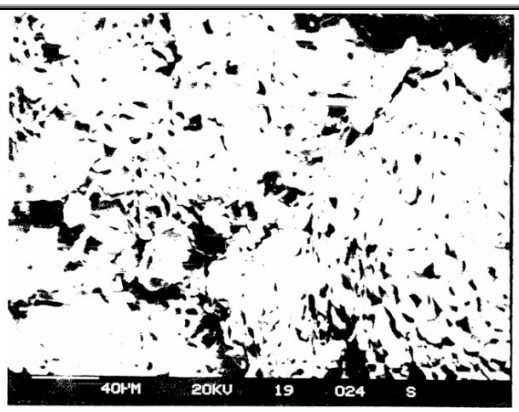


Figure (7) Morphology of oxide layer formed on alloy(B) after 60hr of oxidation at 550°C

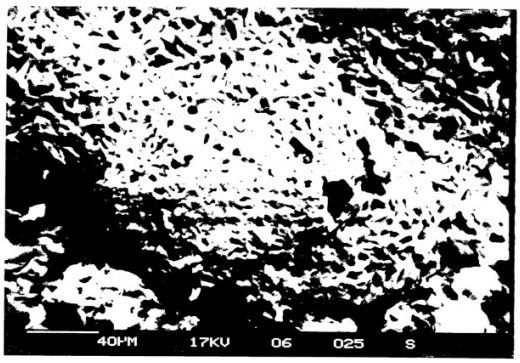


Figure (8) Morphology of oxide layer formed on alloy(C) after 60hr of oxidation at 550°C

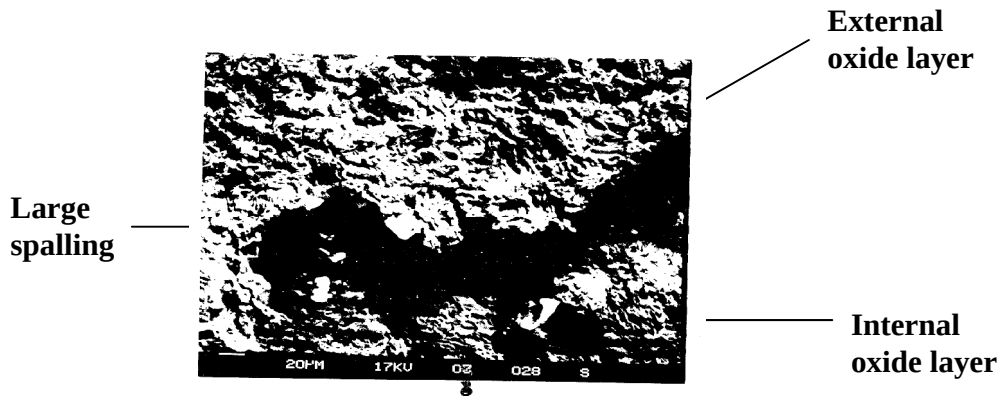


Figure (9) Cracking and large spalling of external oxide layers on alloy (A) when subjected to thermal shock after 50hr of oxidation at 550°C

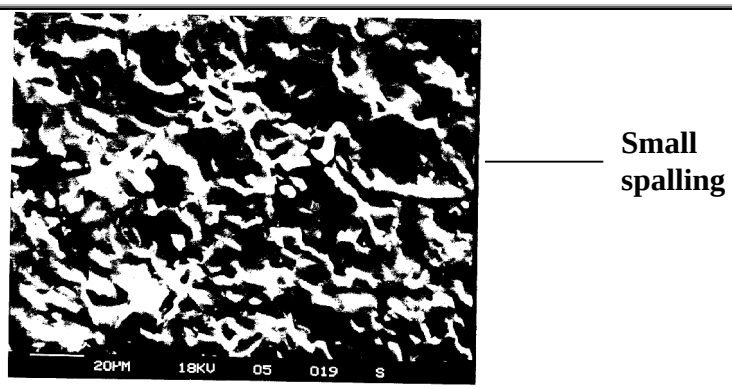


Figure (10) Small spalling of oxide layers on alloy(B) when subjected to thermal shock after 50hr of oxidation at 550°C

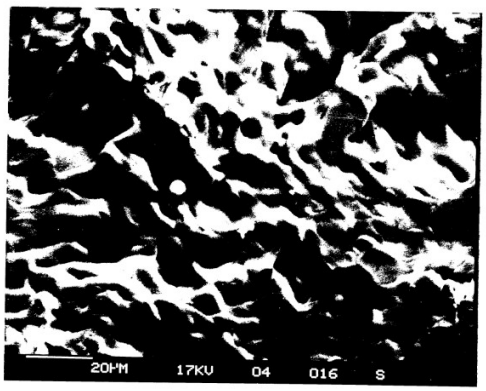


Figure (11) Growing oxide layers on alloy(C) remains sound and intact when subjected to thermal shock after 50hr of oxidation at 550°C

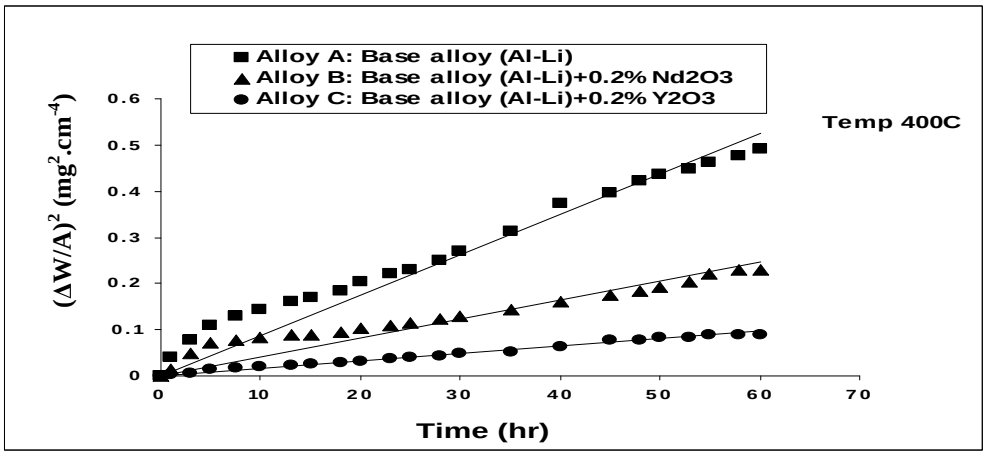


Figure (12) Square of the weight gain/ unit area vs time for alloys(A, B and C) oxidized at temperature 400°C for up to 60hrs

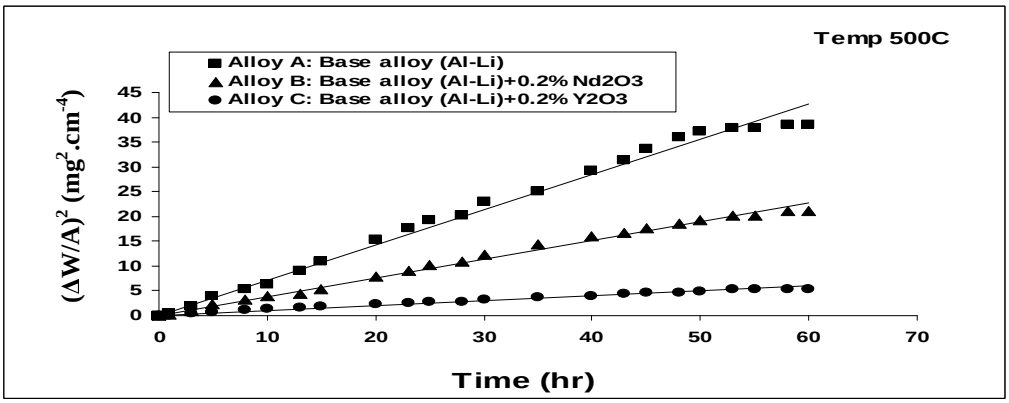


Figure (13) Square of the weight gain/ unit area vs time for alloys(A, B and C) oxidized at temperature 500°C for up to 60hrs

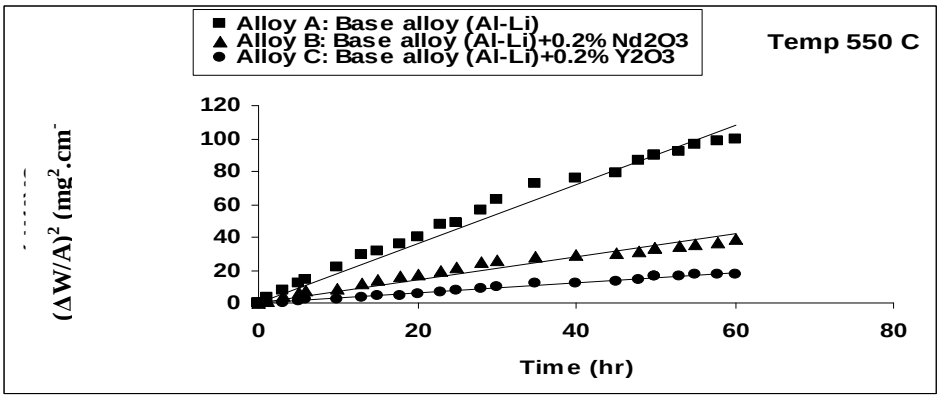


Figure (14) Square of the weight gain/ unit area vs time for alloys(A, B and C) oxidized at temperature 550°C for up to 60hrs

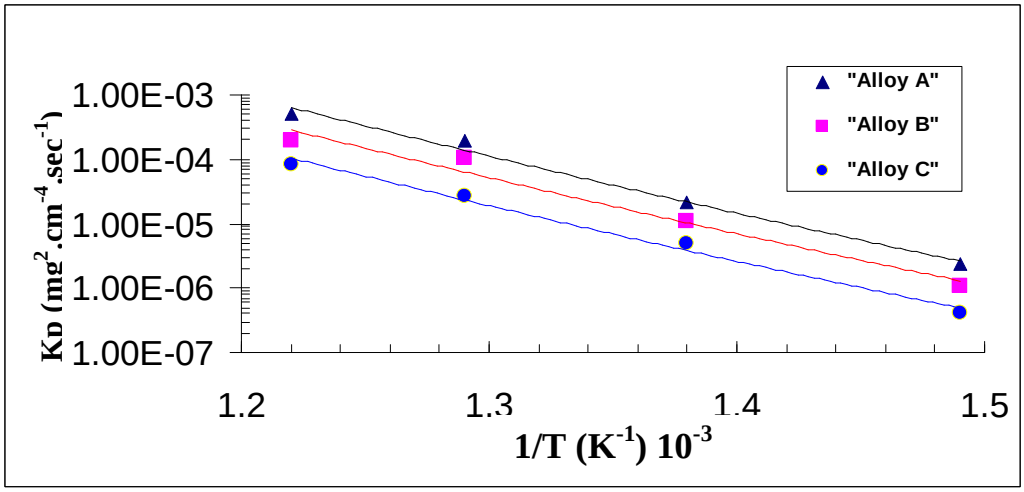


Figure (15) parabolic rate constants for the oxidation of alloys (A, B and C) as a function of temperature for up to 60 hrs in dry air

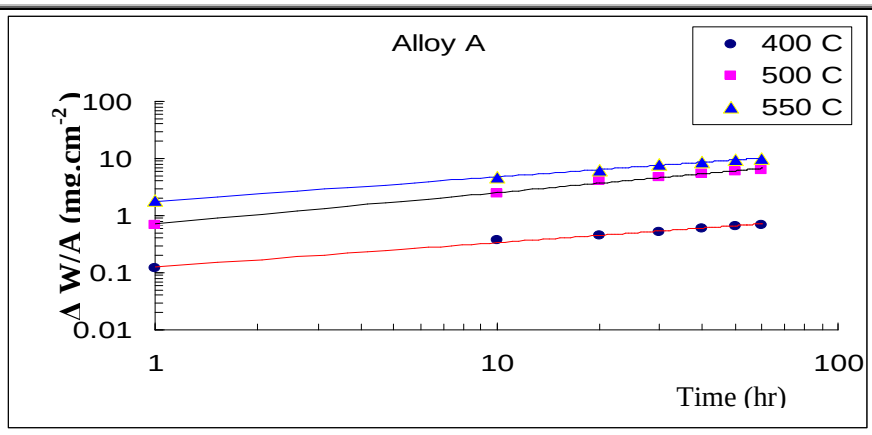


Figure (16) Typical log-log plots of oxidation weight gain data for alloy (A) at temperatures range 400°C-550°C for up to 60hr in dry air

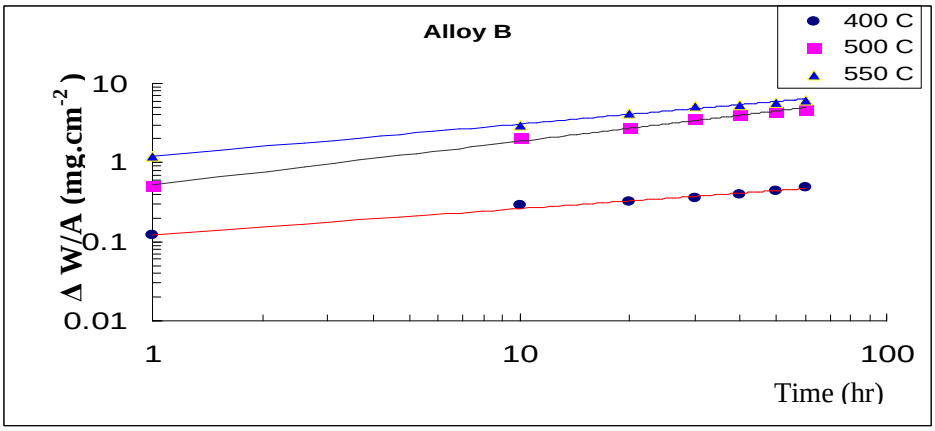


Figure (17) Typical log-log plots of oxidation weight gain data for alloy (B) at temperatures range 400°C-550°C for up to 60hr in dry air

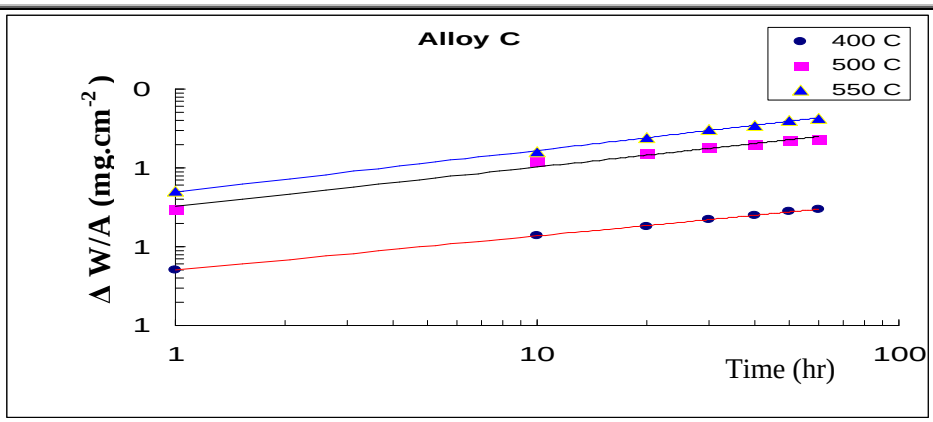
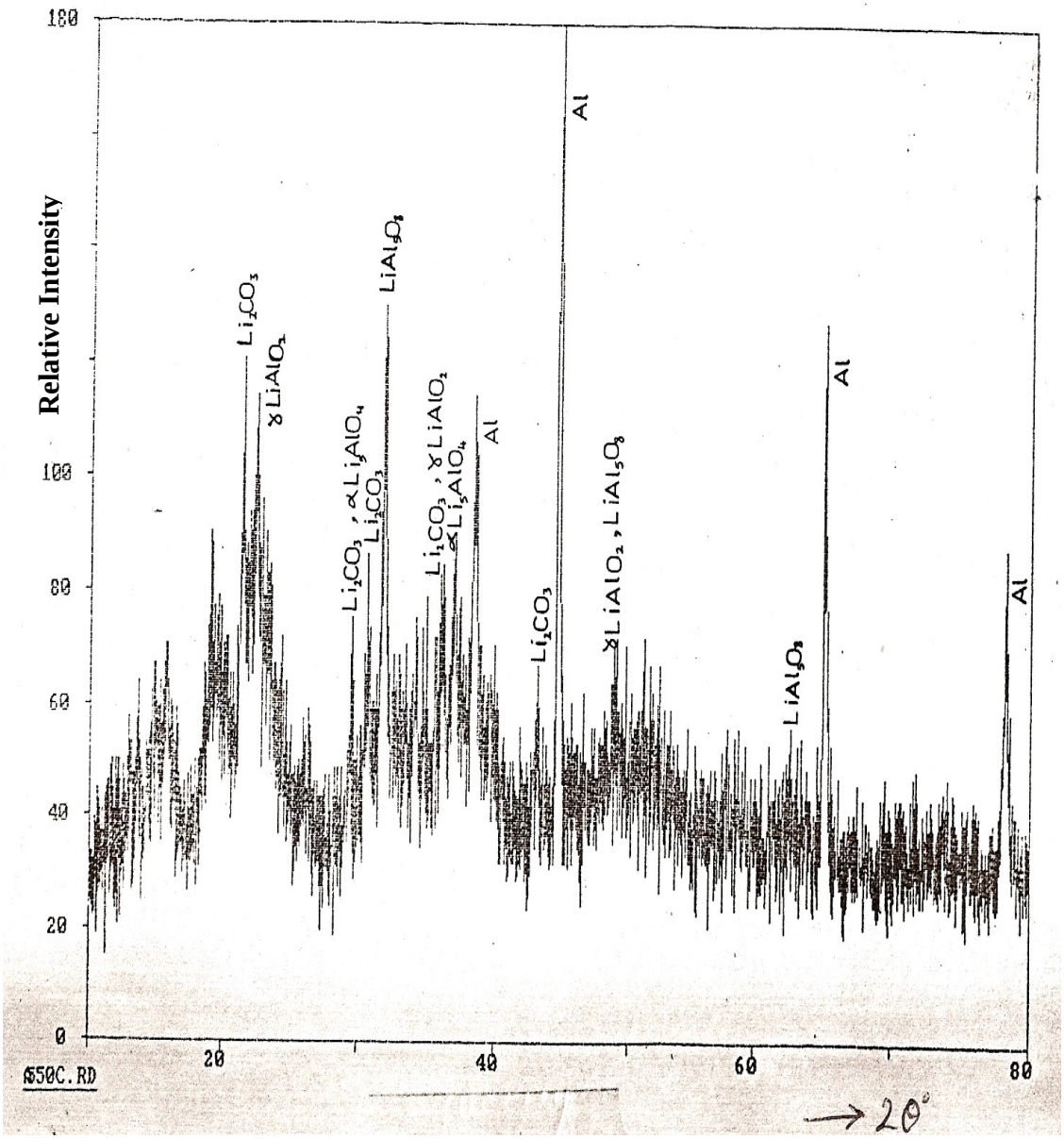
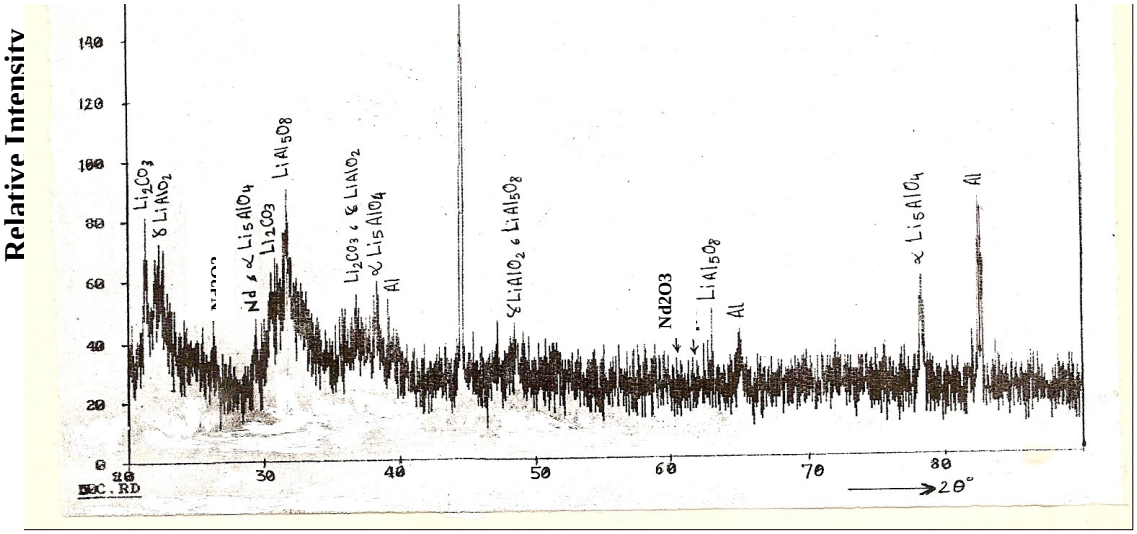


Figure (18) Typical log-log plots of oxidation weight gain data for alloy (C) at temperatures range 400°C-550°C for up to 60hr in dry air


Relative Intensity
100
80
60
40
20
0
20
40
60
80
Li2CO3
γLiAlO2
Li2CO3 , αLi5AlO4
Li2CO3
LiAl5O8
Li2CO3 , γLiAlO2
αLi5AlO4
Al
Li2CO3
Al
γLiAlO2 , LiAl5O8
LiAl5O8
Al
Al
→2θ°

Appendix A : x-ray diffraction analysis of alloy A



Appendix B : x-ray diffraction analysis of alloy B

تأثير اكاسيد العناصر النادرة (Nd_2O_3 وY_2O_3) على السلوك الكيناتيكي للتأكسد لسبيكة المنيوم –ليثيوم

د.منى خضير عباس (أستاذ مساعد)
قسم هندسة الآنتاج والمعادن/ الجامعة التكنولوجية

الخلاصة

تم دراسة التأكسد لسبيكة أساس(المنيوم– ليثيوم) تحتوي على كميات قليلة من الدقائق الاوكسيدية من العناصر النادرة (Nd_2O_3 وY_2O_3) في درجات حرارية (300°C– 550°C). وتم تحضيرهذه السبائك بعملية الصهر والصب في قوالب فولاذية وتحت أجواء مسيطر عليها. أن عنصر الليثيوم يتأكسد انتقائيا مكونا مجموعة من الآكاسيد Li_2CO_3 , $LiAl_5O_8$, Li_2O و Li_5AlO_4 وكانت قيم ثابت معدل التأكسد القطع المكافئ (K_p) للسبيكة الاساس أعلى مما في حالة السبائك الاخرى الحاوية على أكاسيد Nd_2O_3 وY_2O_3 تحت ظروف مماثلة.

وجد ان السبيكة الحاوية على دقائق الياتيريا (Y_2O_3 0.2%) تمتلك أقل معدل تأكسد اي اعلى مقاومة تأكسد مقارنة مع السبائك الاخرى. وكذلك وجد ان الاكاسيد المتكونة على االسبيكة الاساس (Al-Li) تتعرض الى التشقق والتقشر عند أجراء الصدمة الحرارية في درجة حرارة 500°C و550°C بعد مرور 50 ساعة من التأكسد.

تم التعرف على السلوك الكيناتيكي العام للتأكسد بأجراء قياسات الوزن المكتسب للسبائك عند التأكسد الايزوثرمي في الهواء الجاف وكذلك اجراء فحص حيود الاشعة السينية. وأستخدام المجهر الالكتروني الماسح لدراسة طوبوغرافية وبنية الطبقات الاوكسيدية المتكونة على السطح، وقد أظهرت نتائج التأكسد ان كل السبائك تخضع لقانون القطع المكافئ في جميع الدرجات الحرارية المستخدمة في البحث ما عدا الدرجة الحرارية 300°C حيث تخضع تقريبا للقانون اللوغارتمي.