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Laws of Mixing for Oxides and Other Materials

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ABSTRACT

Any research of any kind of material requires few standard statements or laws on the basis of which it is accomplished. This paper includes study on mixing of oxides and other materials using mass law and logarithmic law of mixing. Various parameters like density function and distribution function are studied. Calculation of probability of failure and reliability attributes of materials used in electrical engineering has been made in this paper. The mass law has been defined for a set of parameters. Simulation of Mass law of mixing in a simple manner has been done. Samples are inspected and from the inspection conclusion has been drawn about the totality called the population. Variation of resistivity of elements and oxides with temperature has also been studied. Several notions are taken to advance the study for reliability of materials. The effects of the earth environment, water and pollution are considered in the study of reliability of oxides.

Keywords: *The parameters such as density, resistivity, dielectric constant, magnetic permeability, melting point, thermal conductivity*

1. INTRODUCTION

This document deals with the mass law and logarithmic law of mixing of oxides and other materials. Mass law of mixing is valid in microscopic space as well as the macroscopic space of parameters. The equation (9) explains large number of oxides. Sample testing in random manner is also described for oxides. The parameters are exploited to make electronic transducers using article (3). In most cases the inspection of each item of a production is expensive and time consuming. Hence instead of inspecting all the manufactured item just a few of them called samples are inspected and from this inspection conclusion can be drawn about the totality called the population. The population can be inspected by mass law of items. The highly random problem of probability can be simplified in a précised manner by selecting the variables and their percentage contribution made in the variation of parameter.

If 100 oxides of SiO_2 are drawn from a lot of 10500 items and 5 of them are found defective. Then the conclusion can be made that about 5% of the lots are defective, provided that the oxides were drawn at random i.e. each oxide of the lot had the same chance of being drawn. It is clear that such conclusion is not absolute. More dependable the conclusion will be, more randomly selected oxides are inspected in the lot. Using the theory of mathematics probability, the vague intuitive notions can be made precise. Furthermore, this theory will also yield measures for the reliability of conclusions about population obtained from sample by statistical methods. The mass law can penetrate other large number of factors and variations in the material quality and the results will be optimistic.

Density function and distribution function of probability of parameters of alloys, mixtures and oxides can be studied using mass law and logarithmic law of mixing. The probability of failure and reliability attributes of materials used in engineering and electrical engineering can also be calculated using mass law and logarithmic law of mixing. The equation (23) will be used for this purpose where eleven components or constituents can be analyzed.

The parameters such as density (D), resistivity (ρ), dielectric constant (ε_r), magnetic permeability (μ_r), melting point $_{(MP)}$, thermal conductivity (Tc), and other related parameters follow mass law and logarithmic law of mixing. The alloys and oxides show different behavior under different forces. The tensile strength $_{(T)}$ of alloys and oxides changes randomly under electrical forces or mechanical forces. The tensile strength under magnetic forces will be different to the mechanical forces.

If the volumetric content of Iron is mixed in the copper, aluminum nickel, chromium and manganese the resistivity will change randomly and increasing or decreasing in a random manner. The frequency of occurrence of resistivity or density can be obtained for a particular volumetric content. There will be a vast difference between the physical parameters is calculated while effective parameters are measured [26, 27]. We can take their oxides after wards because the oxides will also follow the same procedure.

It can be noticed that the measured resistivity is very larger than the calculated resistivity of elements/alloys. Similarly the magnetic permeability measured and calculated has vast difference and there are points to explain the characterization of oxides, alloys and elements. Resistivity and density of materials can be calculated in the laboratory.

The error will be obtained and the variation of error under large forces will be a random variable and their frequency and distribution function will be obtained. There will be two modes of the reliability [6], static or built in and dynamic reliability. The dynamic reliability will depend on the nature of the error and its changes. The reliability in large components can be designated as physical, mechanical, electrical, thermal, photoelectric, magnetic and electromagnetic reliability. Large number of materials fails abruptly as the subtle parameters are not calculated and measured.

Mass law and logarithmic law of mixing and their probability distribution functions and frequency distribution investigate the hidden errors of working alloys and mixtures. Even a minute particle of dust of metal can affect the mass parameters sharply. The change of resistivity and density can be noticed for mixtures of dielectrics, semiconductor and conductors which are made by oxides of Aluminum, Iron, copper, Silicon, Magnesium, Manganese, Sodium, Potassium, calcium etc. The problem of cermets, ceramics and ferities can be solved in the heterogeneous condition. The nature of homogeneous materials will be different. The problems of fatigue, creeping, cracking rupturing are solved by these laws of mixtures, and oxide materials.

The iron content in the iron ore, along with measurements of density, resistivity and dielectric constant can be found by mass law inversion. The inversion of the mass law is not linear and only one sided. The random results obtained by mass law inversion can be solved by distribution frequency and distribution function.

Simulation of Mass law of mixing in a simple manner the mass law will be defined for a set of parameters. Here eleven parameters can be assumed, which play an important role of eleven components of materials and reliability. Parameter matrix would be $[\rho]$and $[V]$the volumetric vector.

The alloy or a mixture will be assumed with eleven volumetric contents of metals or oxides to find their properties. It is only one sided but attempts are made to invert it to find otherwise. Large number of alloy contents will advance the study to collect the physical, electrical, mechanical, thermal and magnetic parameters of the material. Even the microscopic parameters follow this law. The electronic concentration(n), mobility(μ), relaxation time(τ), drift velocity (V_{drift}), current density(J), flux density (B)can be assumed to follow these two laws of mixtures.

The process of mass production of screws, bolts, light bulbs, type writer keys, brass, steel's/bronze's high resistivity alloys, contact materials, etc can be controlled in the quality by mass law of inversion and mass law of mixing.

Sample testing in a random manner In most cases the inspection of each item of a production is expensive and time consuming. It may even be impossible if it leads to the destruction of the item. Hence instead of inspecting all the manufactured item just a few of them called samples are inspected and from this inspection conclusion can be drawn about the totality called the population. The population can be inspected by mass law of items. The highly random problem of probability can be simplified in a précised manner by selecting the variables and their percentage contribution made in the variation of parameter.

The highly random parameters can be made précised using mass law of random variables. Moreover, the mass law parameters can be compared with the measured or effective parameters of oxide mixtures such as cermets, ceramics and ferrites. It can be predicted, whether the effects of processes, method, formulas, workmanship and machinery functions are positive or negative. An example of mass law on metals then their oxides can be taken to have a picture of resistivity.

2. MASS LAW AND LOGARITHMIC LAW

The density function and distribution function of probability of parameters of alloys, mixtures and oxides can be studied using mass law and logarithmic law of mixing. The probability of failure and reliability attributes of materials used in engineering and electrical engineering can be calculated using mass law and logarithmic law of mixing.

The parameters such as density(D), resistivity (ρ), dielectric constant (ε_r), magnetic permeability(μ_r), melting point (MP), thermal conductivity (T_c), and other related parameters follow mass law and logarithmic law of mixing. The alloys and oxides show different behavior under different forces. The tensile strength (T) of alloys and oxides changes randomly under electrical forces or mechanical forces. The tensile strength under magnetic forces will be different to the mechanical forces.

If the volumetric content of Iron is mixed in the copper, aluminum nickel, chromium and manganese the resistivity will change randomly and increasing or decreasing in a random manner. The frequency of occurrence of resistivity or density can be obtained for a particular volumetric content. There will be a vast difference between the physical parameters are calculated while effective parameters are measured. Their oxides can be taken after wards because the oxides will also follow the same procedure. If there is a change or in the pattern will discuss the reason of the matter.

It can be noticed that measured resistivity is very larger than the calculated resistivity of elements and alloys also. Similarly the magnetic permeability measured and calculated have vast difference, and here, there are points to explain the characterization of oxides, alloys and elements.

It can be calculated the resistivity and density of materials in the laboratory. The measurement on alloys are simple but can not calculate the resistivity of alloys and mixtures of oxides. The reliability of materials is the new phase in the researches. The difference between the effective parameter and physical parameter will give error:

(Effective parameter - physical parameter = error) (1)

The error will be obtained and the variation of error under large forces will be a random variable and their frequency and distribution function will be obtained. There will be two modes of the reliability, static or built in and dynamic reliability. The dynamic reliability will depend on the nature of the error and its changes. The reliability in large components can be designated by parameters such as physical, mechanical, electrical, thermal, photoelectric, magnetic and electromagnetic reliability, Large number of materials fail abruptly as the subtle parameters are not calculated and measured.

The cermets, ceramics, and ferrites are made using oxides, and they are partly, alloys and mixed. Under heated conditions one can discuss on:

a. Heterogeneous mixture

b. Homogeneous mixture

The hidden errors of working alloys and mixtures are investigated by mass law of mixing and logarithmic law of mixing and their probability distribution functions and frequency distribution. Even a minute particle of dust of metal can affect the mass parameters sharply. The change of resistivity and density can be noticed for mixtures of dielectrics, semiconductor and conductors which are made through oxides of Aluminum, Iron, copper, Silicon, Magnesium, Manganese, Sodium, Potassium, calcium etc. The problem of cermets ceramics and ferities can be solved in the heterogeneous condition. The nature of homogeneous materials will be different. The problems of fatigue, creeping, cracking rupturing are solved by these laws of mixtures, and oxide materials. Oxides are weak and rarely used to make parts of dynamic elements.

Engineering statistics concerned with methods of designing and evaluating experiments to obtain information about practical problems. For example inspection of quality of raw materials and manufactured product can be handled using mass law and logarithmic law of heterogeneous mixtures.

The iron content in the iron ore, with measuring density, resistivity and dielectric constant may be found by mass law inversion. The inversion of the mass law is not linear and only one sided. The random results obtained by mass law inversion can be solved by distribution frequency and distribution function.

The Earth has all oxides and following materials.

$$(O_2, Si, Al, Ca, Na, K, Mg, H_2, and\ all\ other\ materials) \quad (2)$$

$$(49.13,\ 26,\ 7.45,\ 4.2,\ 3.25,\ 2.4,\ 2.35,\ 2.35,1,1.87) \quad (3)$$

When any ore of materials is got , this is in the form of oxides of Si, Al, Ca, Na, k, Mg and H_2.

$$O_2, SiO_2, Al_2O_3, CaO, NaO, K_2O, MgO, and\ \ H_2O \quad (4)$$

These oxides are not very useful but SiO_2, Al_2O_3, MgO are used mostly in Ferrites, ceramics and cermets, after heating them in electric furnaces. The alloys can be inverted using mass law to obtain particular volumetric content and its impact on the reliability attributes of the alloys under large number of forces.

2.1 Simulation of Mass Law of Mixing

In a simple manner the mass law will be defined for a set of parameters. Here one can assume eleven parameters which play an important role of eleven components of materials and reliability. Parameter matrix would be $[\rho]$ and $[V]$ the volumetric vector.

A parameter vector can be simulated as follows:

$$[\rho] = (D, \rho, \varepsilon_r, \mu_r, MP, BP, T_c, T, V, SH, n) \quad (5)$$

volumetric content vector can be found

$$(V)=(V_1,V_2,V_3,V_4,V_5,V_6,V_7,V_8,V_9,V_{10},V_{11})$$

The connecting matrix $[D,j]$would be:

$$[D_j]\Rightarrow\begin{bmatrix} D_1\,D_2\,D_3\,D_4.......................D_{11}\\ \rho_1\,v_2\,\rho_3\,\rho_4.........................\rho_{11}\\ \varepsilon_{r1}\,\varepsilon_{r2}\,\varepsilon_{r3}\,\varepsilon_{r4}.......................\varepsilon_{r11}\\ \mu_{r1}\,\mu_{r2}\,\mu_{r3}.........................\mu_{r11}\\ MP_1\;MP_2\;MP_3..................MP_{11}\\ BP_1\,BP_2\,BP_3......................BP_{11}\\ Tc_1\,Tc_2\,Tc_3.........................Tc_{11}\\ T_1\,T_2\,T_3..............................T_{11}\\ V_1\,V_2\,V_3..............................V_{11}\\ SH_1\,SH_2\,SH_3....................SH_{11}\\ n_1\,n_2\,n_3...............................n_{11} \end{bmatrix} \tag{6}$$

$$[\rho_j]\Rightarrow\begin{bmatrix} Density\;\;Kg/m^2 & D\\ \mathrm{Re}\,sistivity & \rho\\ Permittivity & \varepsilon_r\\ Permability & \mu_r\\ Melting\;\;po\,\mathrm{int} & MP\\ Boiling\;po\,\mathrm{int} & BP\\ thermal\,conductivity & Tc\\ Tensil\;strength & T\\ Viswsity & V\\ Specific\,heat & SH\\ \mathrm{Re}\;fractive\;Index & n \end{bmatrix} \tag{7}$$

$$[V]_i=D_j^{-1}P_j \tag{8}$$

The alloy or a mixture will be assumed with eleven volumetric contents of metals or oxides to find their properties. It is only one sided but attempts are made to invert it to find otherwise. Large number of alloy contents will advance the study to collect the electronic, physical, electrical, mechanical, thermal and magnetic parameters of the material. Even the microscopic parameters follow this law. The electronic concentration (n), mobility(μ), relaxation time (τ), drift velocity (V_{drif}) current density (J), flux density (B)can be assumed to follow these two laws of mixtures.

The processes, mass production of screws, bolts, light bulbs, types writer keys, brass, steels, bronzes, high resistivity alloys contact materials can be controlled in the quality by mass law of inversion and mass law of mixing.

The reason for difference in the quality of product caused by large number of factors in the raw materials, functions of automatic machine workmanship, whose influence can note be predicted, so that variation must be regarded as a random variation and may be solved by mass law of inversion and direct mass law of mixing using other factor contribution.

2.2 Oxides Study on Mass Law

The formation of oxides will depend on the various methods. They have been taken from tables which are will known and examined by mass law of Earth materials. 10 oxides would be tested. We examine their density in D, resistivity, ρ and dielectric constant ε_r for the mixture as follows:

$$ZnO+Fe_2O_3+Fe_3O_4+HgO+NiO+SiO_2+MgO+Al_2O_3+CuO+Cu_2O_3 \tag{9}$$

The mixture is represented by (Table 3.4)

$$D=5.676,g/cm^3,\;\rho=147\,\Omega-m\;\varepsilon_r=7.793 \tag{10}$$

This alloy or mixture is comparable to earth materials of Density $D=5.53$. The dielectric constant of the Earth is 15 and this mixture is safe from shock hazards as $\varepsilon_r=7.793$, resistivity $\rho=147\,\Omega-m$ which is lower to the resistivity of Earth, water and Air where $\rho=200\Omega-m$ for each system.

Some oxides useful for nuclear Engineering materials are [21,22,23].

$$UO_2,U_3O_8,PuO_2,ThO_2 \tag{11}$$

There density would be:

$$D=(10.97,\,8.38,\,11.46,9.82)\;\text{respectively} \tag{12}$$

Melting point would be:

$$MP=(3153,\,2773,\,2513,\,3573^{\circ c}) \tag{13}$$

$$10UO_2+20U_3O_2+30\,PuO_2+40ThO_2 \tag{14}$$

Mixture has a density 10.466 and $MP=3098.5^{\circ c}$ [19,21]

$$UD_2+50U_3O_8 \qquad D=9.875,MP=2963 \tag{15}$$

$$20\,PUO_2+80ThO_2 \qquad D=10.148,MP=3361 \tag{16}$$

the electronic resistivity of all these oxides never exceeds move than $100\Omega-m$

the dielectric constants $\varepsilon_r<15$.

2.3 Sample Testing in a Random Manner

In most cases the inspection of each item of a production is expensive and time consuming. It may even be impossible, if it leads to the destruction of the item. Hence instead of inspecting all the manufactured item just a few of them called sample are inspected and from this inspection conclusion can be drawn about the totality called the population. The population can be inspected by mass law of items. The highly random problem of probability can be simplified in a précised manner by selecting the variables and their percentage contribution made in the variation of parameter.

If 100 oxides of SiO_2 is drawn from a lot of 10500 items and 5 of them are found defective then it can be concluded that about 5% of the lot are defective provided the oxides were drawn at random that is so that each oxide of the lot had the some chance of being drawn. It is clear that such conclusion are not absolutely certain, that is it cannot be predicted that which lot contains precisely 5% defective materials but in most cases, such a precise statement would not be of particular practical interest any way. Also it has been felt that the conclusion will be more dependable the more randomly selected oxides, are inspected in the lot of variety of oxides. Using the theory of mathematics probability one shall see that the vague intuitive notions can be made precise. Furthermore, this theory will also yield measures for the reliability of conclusions about population obtained from sample by statistical methods. The mass law can penetrate other large number of factor and variations in the material quality and the results will be optimistic. The following can be solved using mass law.

a. Elongation
b. Volumetric expansion
c. Temperature coefficient of resistance
d. Thermal conductivity
e. Impacts
f. Irregularities
g. Cavities
h. Temperature ingredients
i. Tension
j. Fatigue, cracks, creeps, brittles fractures

The highly random parameters can be made précised using mass law of random variables, more over the mass law parameters can be compared with the measured or effective parameters of oxide mixtures such as cerments, ceramics and ferrites. The magneto-dielectrics, ferroxdures may be solved using oxides materials. The effect of processes, method, formulas, and workmanship and machinery functions, can be predicted as positive or negative. An example of mass law on metals then their oxides can be taken to have a picture of resistivity.

$$0.7\,Mn + .6\,Ni + 12\,Cr + 3.5\,Al + 83.2\,Fe$$

The volumetric concentration would be

$$(V1, V2, V3, V4, V5) = (.7, .16, 12, 3.5, 83.2) \quad (17)$$

The resistivity calculated would be:

$$(\rho)mass\,law = 11.916 \times 10^{-8}\,\Omega - m$$

The resistivity measured would be:

$$(\rho)effective = 127.5 \times 10^{-8}\,\Omega - m \quad (18)$$

$$\text{Error} = 115.584 \times 10^{-8}\,\Omega - m = \Delta\rho \quad (19)$$

The resistivity measured will depend on the voltage and current and their nature. The disturbance made by the $\Delta\rho$ will play an important role in the dynamic reliability and probability of failure of the alloy, and oxide mixtures in cerments, ceramics, ferrites and Ferroxides. We consider here a simple problem and similar line will be followed for oxides of:

$$MnO + NiO + CrO + Al_2O_3 + FeO + Fe_3O_4 + Fe_2O_3 \quad (20)$$

The resistivity of oxides will be higher to the elements, a law can be formed,

$$\rho_T = \rho_o e^{\alpha t} \quad (21)$$

If the resistivity of the above alloy is raised to $14.3165 \times 10^{-8}\,\Omega - m$ by mass law and measured resistivity to $140 \times 10^{-8}\,\Omega - m$, then the new alloy will be obtained by changing V_3, V_4 and V_5 as follows :

$$0.7\,Mn + 0.6\,Ni + 23\,Cr + 4.5\,Al + 71.2\,Fe \quad (22)$$

V_1 is increased by 12% to 23%
V_2 is increased by 3.5% to 4.5%

The V_5 is reduced to 71.2% from 83.2% (23)

Then :

$$\begin{aligned} \Delta V_1 &= V_1 - V_1' = 12 - 23 = -11\% \\ \Delta V_2 &= V_2 - V'_2 = 3.5 - 4.5 = -1\% \\ \Delta V_5 &= V_5 - V'_5 = 83.2 - 71.2 = 12\% \end{aligned} \quad (24)$$

$$\begin{bmatrix} \Delta V_1 \\ \Delta V_2 \\ \Delta V_3 \end{bmatrix} = \begin{bmatrix} 11\% \\ 1\% \\ 12\% \end{bmatrix} = \begin{bmatrix} .11 \\ .01 \\ .12 \end{bmatrix} \quad (25)$$

The $D\rho = 126.5 \times 10^{-8} \Omega - m$ for new alloy

The resistivity measured of alloys is more than calculated one where Iron content is involved or not involved

Table 1

		ρm 10^-8 (Ώ-m)	Pc 10^-5 (Ώ-m)	Dm (g/cm^3)	Dc (g/cm^3)
1	$60Cu + 40Ni$	50	2.5	8.9	8.936
2	$86Cu + 12Mn + 2Ni$	45	6.5	8.4	8.775
3	$1.5Mn + 75Ni + 20Cr + 3.5Fr$	105	50	8.5	8.459
4	$0.7Mn + .6Ni + 12Cr + 3.5Al + 83.2Fe$	1275	12	7.61	7.61
5	$Mn + .6Ni + 23Cr + 4.5Al + 72.2Fe$	140	14.5	7.6	7.6

Where ρ_m :measured resistivity effective $one \times 10^{-8}$

ρ_c :Calculated resistivity physical $one \times 10^{-8}$

D_m :measured density g/cm^3

D_c :calculated by mass law density g/cm^3

The resistivity of the oxides of the same alloys and elements is explained. The measured parameter will indicate the factors such as processes, workmanship, machines, instruments. The calculated will provide us the ideal one and the measured parameters will provide us:

a. The error in the Instruments
b. Manufacture defects
c. Nature of current and voltage
d. Some content making error
e. Electric and magnetic flux
f. Magnetic or diamagnetic
g. Conductor should be diamagnetic

The mass law density function and distribution function is derived for alloys of:

$$f(x) = SiO_2 + MgO + ZnO \quad (27)$$

and random variation of dielectric constant ε_r The dielectric constant varies from 7 to 15 in the analysis of frequency and function. The frequency of occurrence is 8 to measure the result. The logarithmic law is used to plot the frequency and distribution functions and similar results are seen. We will explain the logarithmic law of mixtures or alloys.

2.4 Logarithmic Law of Mixing of Alloys or Mixtures

Large x can be solved using the asymptotic expansion in the probability methods. The large values of X random variables can be solved using:

(i) $\log X$

or

(ii) $In\ X$ (28)

of parameters. The X, represent parameter in our study. The logarithmic law can be followed as follows.

$$\log X = V_1 \log X_1 + V_2 \log X_2 + V_3 \log X_3 + \dots\dots\dots + V_n \log X_n \quad (29)$$

$$In\ X = V_1 Inx_1 + V_2 InX_2 + V_2 InX_3 + \dots\dots + V_n InX_n \quad (30)$$

The graph of $e^x, \log x$ and In x can be plotted in the x-y plane of the variable to make density function f(x) and Distribution function F(x). the exponential function e^x is the major in this connection, the inverse of e^x is the natural logarithm Inx.

It is satisfied in the equations:

$$In\,(X.Y) = In\ X + In\ Y$$

$$In\ \frac{X}{Y} = In\ X - In\ Y \quad (31)$$

$$In\left(X^a\right) = a\ In\ X$$

$$e^{InX} = X$$

$$e^{-InX} = In\frac{1}{X} = \frac{1}{X} \quad (32)$$

The Inverse of the exponential function 10^X is the logarithmic of base, 10 which is adopted by: [53-59]

$$\log 10^X \quad (33)$$

Or simply by $\log 10^X$

We fined that :

$$\log 10^X = M^{In} X \quad (34)$$

$$M = I_n \text{ x} = 0.4343$$

$$In\ X = \frac{1}{M} \log X \quad (35)$$

$$\frac{1}{M} = In\ 10 = 2.3025$$

For the above five alloys, one can use the logarithmic law to calculate density Dc and Dm as follows:

Calculation = $D_c = (8.9125, 8.74, 8.16, 6.16, 7.33)$ (36)

Measured = $D_m = (8.9, 8.4, 8.5, 7.5, 6.9)$

$$\rho_m \times 10^{-8} = (50, 45, 105, 127.5, 140)$$

$$\rho_c \times 10^{8} = (25, 45, 50, 12, 14.5) \quad (37)$$

The laws for resistivity and Density can be formed as follows:

$$\rho_T = \rho_o e^{K t}$$

$$D_T = D_o e^{\alpha t} \quad (38)$$

Where α and K are material constants and t is the variable for some factors like workmanship, process, machines instruments and supply given to the material or nature of the forces under which the material is working. Three supply shapes are used:

$$e^X,\ Sin\omega t, u(t) \quad (39)$$

The distribution function $e^X, \log x$ and Inx are well known and very important in the probability theory of parameters:

$$(D, \varepsilon_r, \rho, MP, BP, T_c, SH, n, TV) \quad (40)$$

The exponential distribution function is well known and important in reliability of materials but alloys and mixtures do not obey it. The alloys obey the two laws:

$$\log \text{X} = Y, and \sum_{i=1}^{i=n} \log xi$$

$$\log x = y, and \sum_{i=1}^{i=n} I_n\ x_i$$

The addition of large value of parameters can be obtained by $\log x$ and $In\,x$ Distribution :

$$\sum_{j=1}^{m} f(x) = f(x_1) + f(x_2) + f(x_3) + f(x_m)$$

$$F(x) = \sum f(t) + \leq \quad (42)$$

Where,

$$t \leq x_m \quad (43)$$

The sum of

$$\sum_{j=1}^{m} V_j = V_1 + V_2 + V_3 ... + V_n = 1 \quad (44)$$

In the logarithmic law and mass law the condition must, will be:

$$V_1 + V_2 + V_3 + ...V_n = 1 \quad (45)$$

Or

$$V_1 + V_2 + V_3 + ...V_n = 100$$

If the sum in not exactly 100 or 1 the random variable are used to find their properties values till they satisfy the condition given above. The inversion of mass law is another more suitable for the study and it is a tool of random variables and statistical distribution. There is no inversion of mass law and log law but attempts are made using probability theory of random variables. The distribution function $F(x)$ and frequency $f(x)$ are found such that

$$\frac{dF(x)}{dx} = f(x) \quad (46)$$

The variation of percentage of nickel in copper will yield the increased resistivity. The resistivity of copper is

$$\rho_m = 1.7 \times 10^{-8} \Omega - m \quad (47)$$

and that of nickel is

$$\rho_m = 59 \times 10^{-8} \Omega - m$$

The resistivity of copper nickel alloy can be controlled from 1.7×10^{-8} to 59×10^{-8} and one is empowered to make a variety of alloys. This follows for oxides as well.

2.5 Variation of Resistivity of elements and oxides with temperature

Resistivity of oxides falls down sharply with temperature while elements resistivity increases with temperature. Figure 4.1 and Figure 4.2 represent two graphs for $Cu.Cu_2O$ and Cu_2O_3 and Al and Al_2O_3. These responses can be easily found using calculations and Fuzzy logic relations. One can plot the $\rho/\rho_{\max}$ and $t/T_{\max}$ variables that can provide us better relations as one can predict the maximum variation of ρ and time t.

The graphs show that the oxides are semi conductors.

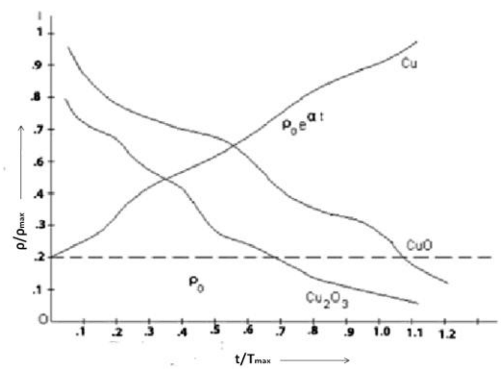

Fig.1: Variation of Resistivity of Cu, CuO and Cu_2O_3

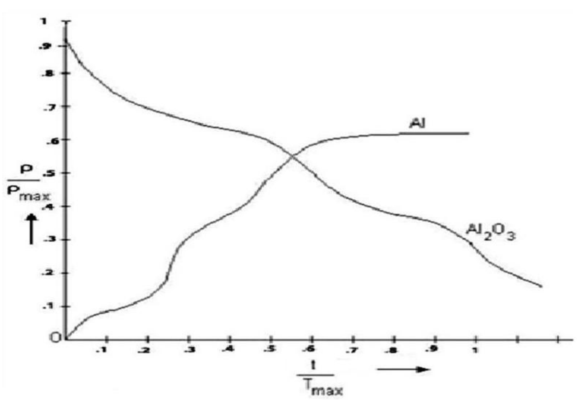

Fig.2: Resistivity variation of Al, and Al_2O_3 with temperature

3. CONCLUSION

In this paper mass law of mixing and logarithmic law of mixing are studied in great details. Mass law and logarithmic law of mixing and their probability distribution functions and frequency distribution investigate the hidden errors of working alloys and mixtures. Sample testing in random manner is conducted. Parameters like density function and distribution function of these samples are studied. Also probability of failure and reliability attributes of materials used in electrical engineering has been calculated. These parameters can be exploited to make electronic transducers and other electronic devices.

REFERENCES

[1] Wayne Nelson Applied Life Data Analysis. Wiley-Blackwel (2004)

[2] "System evolution and reliability of systems". Sysev (Belgium). 2010

[3] Kerre, E.E., Mordeson, J.N. "A historical overview of fuzzy mathematics" (2005)

[4] Khatri, Rajesh, etal., "Study of Neural Networks through vector spaces and their reliability attributes", The Journal of the Institution of Engineers (India), Reference No. BSR/T-185/ET/ED-112, 2006.

[5] Mordeson, J.N., Bhutani, K.R., Rosenfeld, A. Fuzzy Group Theory. (2005)

[6] Ushakov, N.G. "Density of a probability distribution", in Hazewinkel (2001),

[7] De A.k., "Environmental chemistry", 4th Edition, New Age International Publishers (Book) 2001, pp. 20-40.

[8] Khatri, Rajesh etal., "Study of Reliability attributes of Integrated circuits and their failure rates", No. 02368, IB, AMSE, France, 2002.