

## Evaluation of the Structural Mechanics and Surface Realignment of Aluminum by Adenine Kinematic Chemophysio-Orptic Criticalities

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**ABSTRACT:** Aluminum finds diverse application areas in various utility concerns. This limitless capability is a function of its characteristic material properties, which in combination with other materials can be the basis for enhanced applications. However, the deployable lifespan of aluminum can be negatively influenced to the point of redundancy. This situation can be foisted on the metal when environmental degradation consequences such as corrosion is allowed unabated. This paper thus examines the process requirements for aluminum surface reconfiguration in sustaining the challenge of corrosion control which is achieved by the prevention of destructive acidic protons from penetrating the Aluminum-Nitrogen composite structure. The theoretical and practical basis for this phenomenal bonding and antibonding regime is the main crux of this discussion and specifically borders on the structural mechanics of all the process variables involved in the charge transfer chemophysio-orptic mobility propensities. The paper considered the relevance of AlN particulate stability as the basis for surface integrity of the metal and further utilized the equilibrium of inter-atomic and inter-molecular protonic and electronic forces as the fundamental basis for quanta-variant mobility conditionalities and physio-orption criticalities. The balancing trade-off in this finding thus draw inference from process requirements for aluminum surface integrity.

**KEY WORDS:** *variational mechanics, process adsorptivity, physio-option mobility, diffusive absorption, vectorial forces, potential charge transfer*

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### I. INTRODUCTION

Aluminum (Al) occupies a crucial position in light industry applications. It also serves as support structure for applications in heavy facility integrated operations. In view of these enormous applications attributed to aluminum, a proper understanding of the underlying structural mechanics necessary for the corrosion inhibition capability of known organic inhibitors is imperative to proper deployment of the metal. In the foregoing regard, aluminum has a crystalline structure that is defined by face-centered cubic (fcc) and this structure is often impaired during passivation, which is a natural anti-corrosion measure employing a film oxide in surface preservation under atmospheric conditions and impact.

However, at certain operational situations, aluminum is exposed to environmental conditions beyond the protection of its naturally occurring, thin film oxide.<sup>1</sup> Such contact situations as NaCl, HCl and other extreme alkaline and acidic conditions render the protective capability of the film oxide irrelevant and creates opportunity for surface reconfiguration conditions due to structural depletion of the metallic bonds. The result of this depletion is the return of the material to its natural state.<sup>2</sup> The implication of this view is that corrosion reverses the gains of passivation by the reconfiguration of surface conditionalities and structures of the material which is characteristically achieved by acidic contacts and other forms of corrosion initiators.

It is therefore suggestive that the anti-corrosion property of aluminum possesses a surface reconfiguration capability. This implies that in order to protect the surface from corrosion and degradation, the deployment of *adenine physio-option mobility* is consequentially that of recrystallization and re-orientation of metallic bonds cleavages resulting realignments and electrons re-combinations; thus creating a composite structure within the thin film profile of the aluminum surface. The focus of this paper therefore is to examine and expound the structural realignment mechanics of aluminum under this condition by determination of the mobility dynamics of adenine as an industrial surface protective measure.

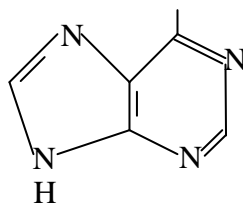
Secondly, studies have shown that physio-chemical potentiation play crucial roles in these surface re-configuration conditions.<sup>3</sup> This role shall be investigated to indicate by way of structural illustration the relative *particulate chemophysio-orptic mobility propensities* in relation to the *quanta-variant conditionalities* for structural bonding limited to surface permeability situations. Thus, a forensic evaluation of residual composites and structures resulting from these surface reconfigurations is of a crucial concern in materials thin film protection enhancement and surface integrity engineering.

It is thus instructive to note that the thin film under investigation has stability within the scale range of 4 - 8.5 pH medium.<sup>4</sup> The implication of this position is that organic inhibitors such as adenine retard or retrogress the rate of corrosion of aluminum by *diffusive absorption*<sup>5</sup> within the periphery of the surface of the metal and we posit that this is achieved by “sequential parameter charge transfer” from charged inhibitor molecules to a potentially charged metal surface.

The condition described above, is referred to as *process adsorptivity*. Further, a second means of transfer is by electron relocation from the inhibitors molecule to the vacant *d-orbital* of the metal. This is a physio-chemical prone adsorption process and both of these conditions utilize the process of surface-centred structural reconfiguration of the metallic lattice. This study is about the post treatment structural conditions of the surface of aluminum upon application of adenine.

## II. MECHANICS OF ADENINE STRUCTURAL COMPOSITION

Below is a structure of nitrogenous base adenine. It possess certain level of hydrophobic effect and uses hydrogen bonding to support its structure.



**Fig.1 chemical structure of nitrogenous base adenine in vector form**

Thus, the structural condition of adenine which enables it to act as a film coating over the metallic lattice of aluminum is dependent on its ability to form special bonding orbitals, with a relative structural orientation indicative of a partial recrystallization. This study shall therefore discuss the various structural conditionalities for bonding between adenine and the aluminum surface orbitals. Forensically, investigation into the structural complexities of these combinations have been observed to utilize tools that are applicable to theoretical, statistical and structural mechanics.

Although this study shall not approach the discussion under the above tools, tensor and quantum mechanics approach shall be used to determine the bonding strength and effects of external factors and forces on the metal. The strength and simulation of its retrogressive propensity as a function of mechanical processes depreciation, and ultimate tensor failure resulting surface corrosion shall be investigated. Thus, the center of this investigative discuss borders on factors incidental to the breaking of the existing bonds between the interacting orbitals of the purine and the surface orbitals of the aluminum metal.

## III. SUPPORTING MECHANICS AND CO-ORDINATE GEOMETRY OF THE ADENINE-ALUMINUM STRUCTURE

It is important to note that the supporting condition for the adenine-aluminum bond is specifically the structural matrix of aluminum and nitrogen bond. Thus, a careful look at the molecular structure of adenine would reveal that it is made up of covalent bonds between orbitals of nitrogen and hydrogen. The presence of double covalent bonds increase the possibility of potentiated chemical reactions in the sense that process and tensor forces are employed to achieve the change in structure. Thus, the availability of covalent bonds in this regard are crucial in the pairing of orbital electrons to energetically favoured region of space.<sup>6</sup>

In view of the foregoing combination dynamics, it therefore implies that the structural orientation of AlN enables it to possess the following characteristics;

1. uniform microstructure
2. high thermal conductivity
3. high electrical resistivity
4. thermal expansion coefficient close to that of silicon
5. resistance to corrosion and erosion
6. excellent thermal shock resistance

7. chemical stability under atmospheric exposure up to 1380°C
8. surface oxidation occurs at about 780°C and the surface layer protects the bulk up to about 1380°C temperature exposure.

In view of the foregoing, AlN is a good ceramic with very notable commercial properties and benefits in terms of positive deployable features.<sup>7</sup> It is further important to note that these (noted) properties of AlN (as a known composite material) are further impacted on the adenine molecule when contact is established between the Nitrogen atom of the adenine molecule and an aluminum atom by means of reaction and orbital coupling. This paper observes that the adenine-aluminum structure results by means of orbital bonding of reacting particles of the adenine molecule represented by nitrogen and aluminum atoms. In order to illustrate the foregoing theoretical assumption under quantum mechanics of “point in a space consideration”, suffice to utilize *atomic orbitals of reacting atoms* analysis. Thus, the reacting atoms are structurally arranged as follows:

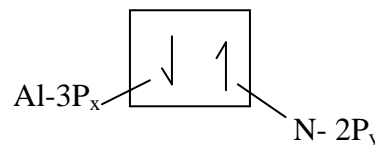
Al – 2, 8, 3, and  
N – 2, 5.

Using *Aufbau principles*, these atoms are further arranged as follows;

Al –  $1S^2 2S^2 2P^6 3S^2 3P_x^1$  and  
N –  $1S^2 2S^2 2P_x^2 2P_y^1$ .

The implication of the foregoing is that the *Pauli exclusivity principle* would be adopted to indicate the spin directions of the electrons Al- $3P_x^1$  and N - $2P_y^1$  under the assumption that both of these external electrons occupy two different energy levels for which Al- $3P_x^1$  must necessarily relinquish some energy to degenerate to the N- $2P_y^1$  orbital in order to bond.

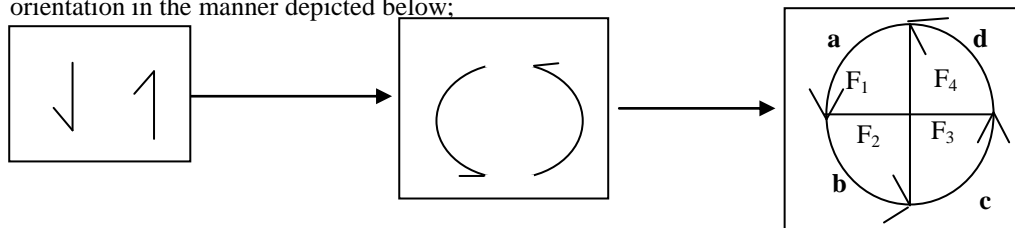
Thus, *Pauli exclusivity principle* assumes that these bonding electrons spin in the following directions.



**Fig 2: Pauli exclusivity principle as applied to AlN bonding electrons**

In figure Fig 2 we demonstrate Pauli spin equivalent of the reacting or bonding electrons using the principle of virtual work to establish the equilibrium resulting from the foregoing mechanical spin system. It should be noted that the Newtonian mechanics of the particles in Fig. 2 asserts that *the equilibrium condition established by the spin directions introduces resultant forces which nullifies each other*. In view of Newtonian considerations in this paper the reacting electrons or particles from the two atoms shall be isolated and their imposed constraints shall be resolved as interacting forces.<sup>8</sup>

In consideration of this kinematical conditions in the analysis of the directional spin forces in this study, the paper shall consider in reversed order, the kinematically impressed forces,<sup>9</sup> on the grounds that instead of analyzing the externally impressed forces as the practice in *variational mechanics of rigid bodies*, the internal forces of *nucleic vibration* resulting the spin interactions in opposite directions would be resolved. It is therefore imperative to note that the spin in the opposite direction in vectorial application implies a cyclic orientation in the manner depicted below:



**Fig. 3 rotation and translation dynamics of spin directions**

On the assumption of reverse vectorial application, let  $F_1, F_2, F_3$  to  $F_4$  operate as forces impacted on the electrons as rigid bodies. Assume that the internally impacted forces are positive attraction forces based on

nucleus energy  $dU$ . Let the attraction forces defined by  $F_1, F_2, \dots, F_n$  act at terminals of the quadrants  $aF_1, bF_2, cF_3$  and  $dF_4$ . Then the virtual displacement of these terminal points can be denoted as,

$$\delta R_1, \delta R_2, \dots, \delta R_n \dots \quad (1)$$

It should be noted that these virtual displacements must be harmoniously viewed in line with kinematical conditions including the radial consequences of cyclic displacements. Further, in the theoretical perspective that the displacements are reversible based on redefined system parameters, the principle of virtual work with respect to the system above, asserts, that *the given mechanical system will be in equilibrium if, and only if the total virtual work of all the impressed forces vanishes*. Mathematically this principle implies that;

$$\overline{\delta W} = F_1 \delta R_1 + F_2 \delta R_2 + \dots + F_n \delta R_n = 0 \dots \quad (2)$$

Analytically, each of the quadrants a, b, c, d could be expressed in their rectangular coordinates of  $x_i, y_i, z_i$  delineated as functions of the generalized coordinates  $q_1, q_2, \dots, q_n$ . The differential form of equation (2) can analytically be summarized into the differential equation,

$$\overline{\delta W} = F_1 \delta q_1 + F_2 \delta q_2 + \dots + F_n \delta q_n \dots \quad (3)$$

where,  $F_1, F_2, \dots, F_n$  are the force components of the generalized impressive force acting from the nucleus of the atoms and forming a vector of the  $n$ -dimensional configuration space. This impressive forces result the equilibrium of the system.

#### IV. EQUILIBRIUM OF ALN BONDING ELECTRONS SPIN AS BASIS FOR MOLECULAR STABILITY

It should be stated that if the AlN bonding electrons are viewed as rigid bodies, then their constant cyclic spin could be seen as the basis for stability of the structural orientations of the AlN molecule, thus befitting of its purpose for corrosion control.

In view of the foregoing, a rigid body whose movement in space is not constrained and as such has free orientation has been found to possess six degrees of freedom<sup>10</sup>, three of which are on the basis of translation and the remaining three on the basis of rotation. Thus, employing the principle of superposition of infinitesimal quantities, these two types of displacements can be applied as follows:-

##### (a) Translational Displacement

It should be noted that the bonding electrons in response to the internally impressed spring-like contraction or vibration forces from their nucleus are infinitesimally displaced from one point to the other. Let  $\epsilon$  be the assumed extent of infinitesimal displacement, and  $B$  a vector of unit length, the virtual work displacement  $\delta R$  of a particle,  $P_i$  (i.e. electron in this case) becomes;

$$\delta R_i = \epsilon B \dots \quad (4)$$

and the work resulting from the displacement within the specified quadrant becomes;

$$\overline{\delta W} = \sum (F_i \epsilon B) = \epsilon B \cdot \sum F_i \epsilon \dots \quad (5)$$

It is instructive to note that at the point of system equilibrium, equation (5) vanishes on the imposed condition that;

$$\overline{F} = \sum F_i = 0 \dots \quad (6)$$

Indicative of the fact that the sum total of the forces impacting on the electrons is a nullity, provided the directional spin is achieved. Thus, system equilibrium condition connote, that vector  $B$  can be applied from any direction on the electron spin within the system, thus implying that a cumulative resultants force  $F$  of all the impressed nuclear forces vanishes. It is the position of this study that this vanishing effect structurally keeps the bonds within the defined orientation and prevents further potentiated reactions with other proton donors.

##### (b) Rotational Displacement

It is important to note that a rigid body such as electron spin in the equilibrium system described above under three degrees of freedom undergo rotational displacement while also undergoing translational displacement. Let  $\varphi$  be the angle defining infinitesimal rotation. Let  $\gamma$  represent a vector of unit length on the same rotational axis. Thus, the displacement of a specified point  $P_i$  resulting from the rotational component of the spin dynamics can be expressed as;

$$\overline{\delta R}_t = \varepsilon \tau \times R_t \dots \quad (7)$$

where  $R_t$  denotes the position vector of  $P_i$  with respect to a defined origin along the axis of rotation.

In terms of work input  $F_t$  can be expressed as;

$$\overline{\delta W}_t = F_t \cdot \varepsilon \tau \times R_t = \varepsilon \tau \cdot (R_t \times F_t) = \varepsilon \tau \cdot M_t \dots \quad (8)$$

$$\text{where vector, } M_t = R_t \times F_t \dots \quad (9)$$

and defines the moment of the force exerted on the electrons from their individual nucleus and collectively serves as the origin of the system.

Thus, under a rotational displacement, the total work of compressive and impressive forces can be expressed as:

$$\delta W = \sum \varepsilon \tau \cdot M_t = \varepsilon \tau \cdot \sum M_t \dots \quad (10)$$

Since rotational dynamics of the electron spins is coupled with the translational displacement, equation (6) and equation (10) are both mirror of each other and complementary equivalents in systemic order of statistical mechanics. This implies that vector  $\tau$  under rotational dynamics takes over the functioning of translation vector  $B$ . In the same vein the moment  $M$  about the axis of rotation from the origin at the nucleus of the atoms replaces the force  $F$ . In the conclusion of this analysis, it should be noted that these spin electrons are only reflective of the component forces and moments, fields and vectoral forms of energy mobility.

Thus, as an agent of the nucleus, valence electrons negotiate the bonding and antibonding processes by means of the potentiated interactions discussed so far. In mechanics of solid bodies a structured combination of these resources ensures an equilibrium. However, this equilibrium can be affected by the presence of infinitesimal translational and rotational impulses emanating from the nucleus, hence requiring that equations (6) and (10) coexist to establish and maintain the general equilibrium of the system.

## V. GEOMETRICITY OF CO-PLANAR AND POLAR STRESSES IN PHYSIO-ORPTION MOBILITY

As depicted below, this study utilized geometric tools to predict or reveal how the interaction of coplanar stresses produce polar coordinates that are crucial for the surface mobility tensions required to sustain the adenine–aluminum bonds. These coplanar forces by design on the one hand are the interactions between bonding electrons as particulate matter in free space and their individual nucleus; and on the other hand interacting forces between the two nucleus and the compressive and impressive forces on their orbitals. This view is from the perspective of process simulation as applicable in mechanics and conditions necessary for the bonds that establish the structure of the adenine-aluminum complex. Thus, the *Augbuf Principle* together with the geometrical relativity of the principle shall be discussed under this sub-heading.

Assuming the electron spin direction of Fig. 2 is relatively considered within the context of co-planar identities, this submission imply that both electrons occupy the *p-orbitals* of their various atoms. Thus, according to the illustration of classical mechanics of nanostructures,<sup>1</sup> electrons occupying the *p-orbital* as in the case of Al, in fig. 2 with  $3p_x$  orbital shape appear as follow;

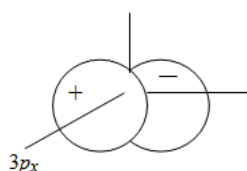
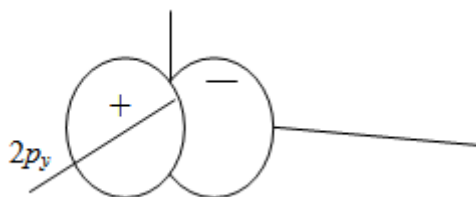


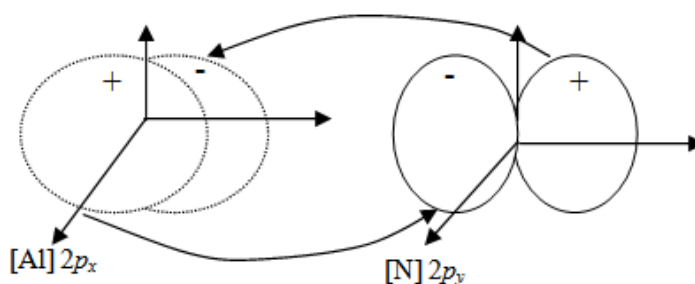
Fig. 4 Aluminum (AL) - $3p_x$  Orbital

In the same vein the lower energy  $2p_y$ -orbital of Nitrogen is shaped in an oval form indicated as;

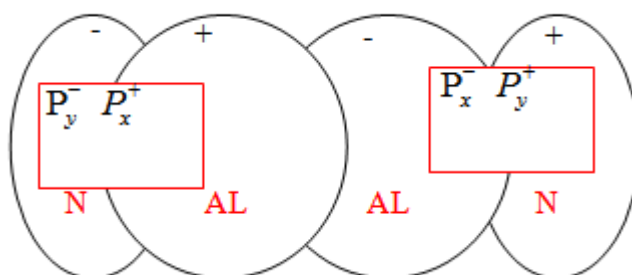


**Fig. 5 Nitrogen (N) - $2p_y$  Orbital**

It should be noted that the indicated bonding surfaces of the  $p$ -orbitals encloses a nodal plane which passes through the nucleus and separates the two lobes that makes up an orbital. These lobes are polarized in nature due to their solid surface orientation defined by bonding forces; and the specific wave function is defined by the polar co-ordinate of the electron. Thus, a magnetic moment exists on the polar orientation under the following stages of reaction.



**Fig. 6 constitution and configuration of polar stresses on the reacting orbitals and bonding electrons - stage 1 rxn.**



**Fig. 7 structural composition of additive and compressive coplanar forces between orbital electrons of Aluminum and Nitrogen- stage 2 rxn**

In view of Fig. 7 above, suffice to say that the arrangement of the atoms under a bonding regime of polarized orbitals is indicative of a plane of co-planar forces interaction with each other to create an equilibrium balance of forces that maintain the bonds and structural complexities of the Aluminum-Nitrogen bond.

Assume that Fig 7 lies on an  $xy$  plane where the  $z$ -axis = 0. This makes the  $xy$  plane a nodal plane of the orbital and due to mobility consequences, the wave functions changes signs as it encounters boundary conditions.<sup>11</sup>

It has been observed that the wave function of  $2p$ -orbitals where  $z$ -axis = 0 and orbital angular momentum,  $m_l = \pm 1$  possesses the form;

$$\psi_{P_{\pm 1}} = R_{2,1}(r)Y_{1, \pm 1}(\theta, \phi) = \mp \frac{1}{8\pi^{1/2}} \left[ \frac{2}{a_0} \right]^{5/2} r e^{-zr/3a_0} \sin \theta e^{\pm i\phi}$$

$$= \pm \frac{1}{2^{1/2}} r \sin \theta e^{\pm i\phi} f(r) \dots \quad (11)$$

It should be pointed out that this complex wave function of the 2p of Nitrogen (N) degenerate orbital forms bond with the 3p of Aluminum (AL). Geometrically, let the N-2py' represent the y -axis and the Al-3px' represent the x-axis, then the z-axis becomes a resultant consequence of these interacting forces. Thus; the shape of such a graph given the unitary value of the orbital electrons holds as follows.

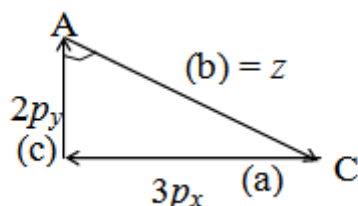


Fig. 8. geometrical representation of the balance of vectorial forces

Geometrically,

$$z = y^2 + x^2 \dots \dots \dots (12)$$

A further analysis of the reacting components on the z-axis show that there exist three interacting forces and two components of reactions designed to maintain the equilibrium of the system. If these fundamental and primary forces<sup>12</sup> are analyzed, their structural interactions is illustrated in Fig, 9 below.

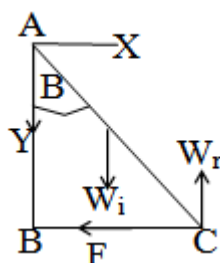


Fig 9 interacting forces and components reactions

It should be noted that Fig. 9 is the geometric balancing of forces indicated in Fig. 8 above. Let the resultant force z be represented by the equilibrium line AC of Fig 9. It could be seen that under the action of the forces F, W<sub>r</sub> and W<sub>i</sub> and components of reactive forces x, y at point A. Thus, an expression of the interacting relationships equated to zero, would produce the sum of moments about A under the expression;

$$W_r x 2a \sin\theta - W_i x a \sin \theta - F x 2a \cos\theta = 0 \dots \dots \dots (13)$$

Hence;

$$F = W_r \tan \theta \dots \dots \dots (14)$$

And;

$$F/W_r = \tan \theta \dots \dots \dots (15)$$

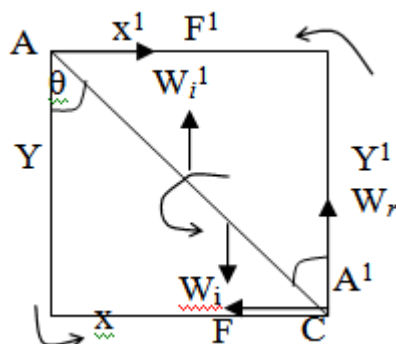
Thus, utilizing the principles of mechanics of dependent structures the resultant line at point C is likely to slip unless  $\tan \theta < \mu$ .<sup>13</sup> Where  $\mu$  is the frictional force of sliding in the absence of a limiting factor at point C. Hence equating the sum of forces in the vertical and horizontal axis of ac, where  $\tan \theta = F/W_r \mu$ , thus;

$$X = F = W_i \tan\theta \dots \dots \dots (16)$$

$$Y = W_r - W_i = \frac{1}{2} W_i \dots \dots \dots (17)$$

$$x/y = 2 \tan\theta = W_r \mu \dots \dots \dots (18)$$

The conclusions arrived at in equation 16, 17 and 18 is indicative of the fact that tipping reactive force at A is inclined at  $\tan^{-1}(W_r/\mu)$  to the vertical axis. Hence, the nucleic forces of attraction which constitute the compressive forces is summed up as  $\Sigma W_i$  on the  $z$ -axis. This force which connect the circular spin activities of the orbital reaction and bonding electrons could be more appreciated if figure 8 is inverted into a complete scheme of a complex molecule as  $[AlN]_2$  relatedly viewed under  $\left[ \begin{array}{c} \uparrow \\ \downarrow \end{array} \right]$  Principle of exclusivity as Graphically the geometry of this relation is;



**Fig 9: molecular representation of interacting forces**

Thus, the forces  $F=F^1$ ,  $Y=Y^1$ ,  $A=A^1$  and  $W_i=W_i^1$  imply that under spin conditions, force distributions are counter balanced by radial forces that are equal and opposite to each other. The relationship of this position to the structural mechanics of the adenine-aluminum bond is crucial to the restructured surface properties of aluminum when coated with adenine as an anti-corrosion purine. As have been observed severely in studies dealing with heterocyclic compounds<sup>14,15,16</sup>, the central issue in all of the cited experimental studies is the fact that the surface condition of the metallic material that has been coated with the substances undergo some changes in its crystalline structure on account of the surface reaction between the inhibitors and the metallic surface. This position is akin to the experimental findings that welding practice results welded joints that has undergone surface restructuring by chemo-structural processes and mechanical variables realignments.<sup>17</sup>

## VI. FINDINGS AND DISCUSSIONS FROM THEORETICAL POSTULATIONS

Experimental results in this study show that aluminum when exposed to environmental factors is noticed to undergo certain surface reconfiguration conditions which degenerates the material to the structure of a metal lower in grade over a protracted period of contact with the corroding medium. This implies that the structural and tensile strength of the metal depletes to the point where it would be put out of service. In this regard, corrosion can be safely said to be an electrochemical process that steadily reverts the *processed metal* into its naturally known state of occurrence before mining and processing. Thus, surface structure reconfiguration is eminent to achieve this natural tendency.<sup>18</sup>

Further, it is also crucial to observe that aluminum, when exposed to environmental conditions comes in contact with atmospheric oxygen thereby forming a tin protective coating of AlO. The strength and capability of this oxide to withstand corrosive tendencies approaches a threshold beyond which it can sustain metallic surface integrity test. Forensically therefore, the structural orientation of the lattice bonds closest to the surface is significantly compromised, when the chemical potentiators sustaining the energy bands between the reacting atoms and their molecular super structures are engaged to chemically interact. This condition forms the basis of the composite structures that are observed within the thin film surface profile of the metal.

In view of the foregoing, the study observed that the theory of “process adsorptivity” which implies surface integrity retrogression by *potential charges transfer* is primarily intended to bring about metallic lattice reconfiguration, which forensically bears relevance under process parameters determinations in the areas of theoretical, structural and statistical mechanics. It is further found that the essence of corrosion studies is to limit the tendencies of defined corrosion initiators. The study observes that this feat is achievable if process tensors in terms of equilibrium of charges are deployed to limit the advent of bond breaking are initiated, then corrosion tendencies could be retarded or abated.

The study also found that the geometrical structure of the aluminum-adenine composite is crucial to its beneficial deployment in highly advantageous conditions such as thermal conductivity, electrical resistivity, thermal shock resistance and chemical processes stability under atmospheric conditions of 1380°C. This implies that the AlN composite at the point of bonding with the adenine molecule also imparts its characteristics and properties to the molecules.



This approach to proper understanding of the composite structure of the aluminum-adenine condition utilized Aufbau and Pauli exclusive principles to depict the reaction pathways and the mechanics of the resulting structures and their molecular stability. This stability derives strength from the equilibrium conditions required to sustain the structure. The forces at play to establish and maintain the reaction equilibrium interact with each other in the form of spring motions arising from adjustments of polar coordinates of co-planar forces under defined rotational and translational displacements. Thus, the role of valence electrons as agents of process reactivity negotiation for bonding and antibonding conditions is necessary for the sustenance of equilibrium.

Finally, the wave function determinants for the  $2P_y$  and  $3P_x$  orbitals is crucial to the spin quantum internal structural balance within the  $xy$  plane. The nodal complexities of this plane thus results the  $z$ -axis question for which geometrical analysis of force vectors under compressive conditions come handy in terms of resolution of the forces under constraint. Thus, the  $z$ -plane therefore acts as a resisting wall of + and – charges in order to repel acidic potentiators from penetrating the thin wall of AlN composite.

## VII. CONCLUSION

The study delved into the basis of structural complexities arising from aluminum-adenine bonds. The strength conditionalities of the bonds determine the culpability or the integrity of the metal. The implication of this finding according to Fig. 9 is that, the force factors of attraction or compression forces giving rise to  $W_i$  and  $W_r$  as impacting and reacting forces at a point  $C$  under the external force  $F$ . Thus, force  $F$  and its alternate  $F'$  are both compressive in nature, just as force  $Y$  and its alternate  $Y'$ . This interaction structurally subtends angle  $\theta$ , whose value determines the stability of the resultant  $z$ -axis. Technically, this argument may require further analysis, but theoretically, a bond is broken when either  $\theta$  is varied as to distort the equilibrium or  $z$  is impacted externally as to increase or reduce the value of  $\theta$ . This means, as suggested in equations (5) and (9) that the equilibrium balance that sustain the bonds is an interplay, between internal systemic forces under the control of the  $z$ -plane and  $\theta$ .

Thus, a distortion of either of these systemic elements of stability and equilibrium by external forces results the breaking of the AlN bond under the  $2P_y$  and  $3P_x$  bonding control.

Practically speaking when aluminum is exposed to corroding elements such acidic medium, the reaction between aluminum and the acidic potentiating proton implies replacement of aluminum atoms by the proton or its bonded element. This fact becomes more appreciated when adenine is used as a corrosion inhibitor, and exposed to a highly concentrated acidic proton medium. Thus upon contact, the potentiating acidic proton  $H^+$  makes effort to penetrate the AlN composite film as to attack and corrode the aluminum metal but is repelled by the resultant  $z$ -plane which is dominated by  $2p_y^-$  and  $3p_x^+$  electrons in a constant spin of electrons in the bonding orbital.

It is further noted that the acidic proton  $H^+$  do not possess the force capability to break the  $2P_y^-$  and  $3P_x^+$  bond which is a protection film and as such cannot access the aluminum metal lattice structure. An exception to this finding could be the subject matter of further studies in this regard but extended to situations of increased concentration of the  $H^+$ .

## REFERENCES

- [1]. Fouda A.S., Gouda M.M., Abd El-Rahman S.I., *Benzaldehyde, 2-hydroxybenzene Derivatives as Inhibitors of the Corrosion of Aluminum in Hydrochloric Acid*, Chem Pharm Bull, 48 (2000), pp. 636-640
- [2]. Eddy N.O., Momoh-Yahaya H., Oguzie E. E., *Theoretical and Experimental Studies on the Corrosion Inhibition Potentials of some Purines for Aluminum in 0.1M HCl*, Journal of Advanced Research, Vol 6, Issue 2, March 2015, pp.203-217
- [3]. *ibid* at p. 203
- [4]. Cobot B.L.,Centellaa, F.A., Garrido J.A., Perez E., Vidal H., *Electrochemical Study of Aluminum Corrosion in Acid Chloride Solution*, Electrochim Acta, 36 (1991), pp. 171-187
- [5]. El Ashry E.H, El Nemr A., Essawy S.A., Ragab S., *Corrosion Inhibitors part III: Quantum chemical studies on the efficiency of some aromatic hydrazides and Schiff bases as corrosion inhibitors of steel in acidic medium*, ARKIVOC, 11 (2006), pp. 205-220
- [6]. Atkins P. W., Physical Chemistry, University Press, Oxford, 1978, p.473
- [7]. More details available and can be viewed at [www.Sumet.Com/Technology/Aln/](http://www.Sumet.Com/Technology/Aln/). visited 12th December, 2017.
- [8]. Lanzos C., The Variational Principles of Mechanics, University of Toronto Press, 4<sup>th</sup> Ed, 1970, p. 74-80.
- [9]. *ibid* at p. 75
- [10]. Atkins P. W., Atkins' Physical Chemistry, Oxford University Press, 2006. p. 332-333
- [11]. *ibid*, Atkins (2006) p. 333
- [12]. Tranter C. J. and Lambe C.H., Advanced Level Mathematics (Pure and Applied) 4<sup>th</sup> Ed., 1994, P. 405-407.
- [13]. *ibid* at p. 407
- [14]. Eddy N. O. Momoh-Yahaya H. and Oguzie E. O., *Theoretical and Experimental Studies on the Corrosion Inhibition Potentials of Some Purines for Aluminum in 0.1 M. HCl*, Journal of Advanced Research, Col 6, Issues 2, March 2015, P. 203

- [15]. Eddy N. O. Ameh P. O., Gimba C. E. Ebenso E. E. Rheological Modeling and Characterization of Ficus Platyphylla Gum Exudates, J. Chem (2013). Available at [http:// dx.doi.org/10.155/2013/254347](http://dx.doi.org/10.155/2013/254347), visited 10<sup>th</sup> January, 2018
- [16]. Elayyoubi S. B., Hammouti S., Kertit H. O., Maarolf E. B., Corrosion Inhibition of Mild Steel in Hydrochloric Acid Solutions by Malonitrile Compounds, Rev. Met. Paris, 2 (2004), pp 153-157.
- [17]. Jumbo E. E., Okpala A. N., Adigio E. M., Chemostructural Conditionalties for Welderbility in Nickel-Chromium Sequenced Dual Nucleation: American Journal of Engineering Research (AJER) Vol. 3, Issue 4, April 2014. ISSN (e): 2320-0847 ISSN (p): 2320-0936, also available at: Vol 3, Issue 4, April 2014 [www.ajer.org](http://www.ajer.org). page 123-127
- [18]. Supra, p. 203 of Eddy N. O. Ameh P. O., Gimba C. E. Ebenso E. E. Rheological Modeling and Characterization of Ficus Platyphylla Gum Exudates cited above.

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