Quasi-Bivariant Potentiations and Complexes in Molecular Manufacturing

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---ABSTRACT---
Molecular interactions giving rise to solid structures are activities that borders on the tensional forces at molecular surfaces. These forces results from energy interactions of transfer and absorption which also utilize molecular surfaces as the medium of transportation. As depicted by this paper, surface potentials responds to two states conditions within which other state space transitions apply and the existing inter-molecular distances thus play a crucial role in the possibilities of shapes that are derivable. Consequently, the structures that are obtainable from the combinatorial bonding of these molecular shapes for different elements determine the resultant range of nano-products and devices. Thus, an appreciable understanding of the manipulation and control dynamics of these bivariant potentiations can unlock unlimited possibilities of molecular combinations of shapes, deployable for varying scientific and industrial needs.

Keywords: Bivariant potentiations, orbital coercivity, nano-miniaturization, substitutional interstitiality, nanomechanics
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I. INTRODUTION

Nano-dimensional manufacturing can be seen as the manipulative control by structural re-orientation or partial reconfiguration of the orbital symmetrics of nanoscale materials in at least $n = k$ dimensions, where $k >1$. This nanoscale orientations and symmetrical variabilities differs between materials; thus giving rise to unlimited range of products and improvements in operational requirements and characteristics. The quality of the engineered items resulting from these varying improvements is a direct function of the efficient utilization of immediate, remote and consequential factors that are fundamental to the existence of the materials.

Thus, the structural components of these materials are identifiable and scalable within the ambit of nanotechnology. This significantly implies that factors such as; ionization potentials, ground state conditions, magnetization, orbital coercivity, quantized quintessential internal energy, field strength of state space, angular momentum and surface excitation thresholds are all manipulative factors at the disposal of molecular manufacturing and their understanding directly enhances the applications of molecular surface potentials in *nanoscale quasi-bivariant conditionalities*.

Further, it should be pointed out, that a critical assessment, analysis and understanding of these factors and others, and their manipulative control produces varying results to the advantage of the manufacturers of nanodevices, and specialized nano-miniaturization possibilities deployed in quality control and assessment regimes, nanomachines, etc. Further, an aggregated imposition of constraints on these behavioral tendencies for which orbital symmetries of associated atoms are considered, results modular substructures capable of super-enhanced characteristics at determinable energy values, [1] and [2].

II. II STRUCTURAL COMPONENTS AND THE SURFACE POTENTIAL FACTOR

When substances interface with highly polarized liquids such as H_2O and NaCl (aqeous) such substances acquire a surface charge either by dissociation of ions from surface into the solution or by preferential absorption of certain ions from the solution, referred to as *substitutional interstitiality* [3]. Accordingly, it has been found that oppositely charges *counter ions* in the solution balances this surface charge at a characteristic small distance from the surface called Debye length, k^{-1} [4].

In view of these findings, it is instructive to state that in namomechanics and nanotribological studies the potentiality of the Debye length drops with rising or increasing ionic strength which is a primary derivative of the molar concentration M_i and valency z_i of the ion. Thus, the mechanics of this inter-ionic behaviour indicates that Debye length can be expressed as;

$$\kappa^{-1} = \left(\frac{\varepsilon\varepsilon_0 k_B T}{e^2 N_A \sum_i z_i^2 M_i} \right)^{1/2}$$

1.1

In furtherance of equation 1 above, this paper finds that the structural composition of chemically certified "pure water" indicate a scale of pH7, which relatively imply that $M_i = 10^{-7}$ M and $k^{-1} = 960$nm which is approximately 1μm.

The foregoing thus imply that surface potential of nanostructured materials respond to bulk interacting and quantized inter molecular characteristics defined by the osmotic limits of adhesivity, $\varepsilon_o K_B T$, which is a critical constraint that is naturally imposed on k^{-1}, and thus requires appropriate considerations with respect to the bivariant possibilities encountered in molecular interactions which *Lifshitz theory*, as has been canvassed in many studies, failed to explain [4].

Notwithstanding this lacuna, a view of the *combinatorial interstitiality* properties of carbon with atomic radius of 0.071nm and iron with atomic radius of 0.124nm reveals that the k^{-1} factor becomes a dynamically localized minima, consequent on the electrolytic conditions of the substance; and by the operation of the osmotic adhesivity, $\varepsilon_o K_B T$, absorption of carbon results, thus satisfying the 59% radii compatibility requirement for the formation reinforced carbon nanorods.

This combinatorial mechanics arising from molecular fusion due to chemical reactivity thus establishes the dependence of k^{-1} on the $\varepsilon_o K_B T$, implying that intermolecular distances are affected by ionic concentrations for which increase in ionic concentration means a decrease in k^{-1} and this results from the osmotic tension of individual molecules, which aggregately impose a limit on the overall modular structure, strength and shape of the molecule. The practical implication of this modularized intermolecular osmotic condition is the fact that the structural composition of combinatorial molecules affects the areas of application in nanofabrications and nanoscale designs.

As pointed above, Debye length represents a permeable vacuum through which atomic properties and characteristics are shared between the interacting atoms and their particles, this further affects the molecules. In this regard, Debye length relates the surface charge density σ of a surface to the electrostatic surface potential ψ_o which according to the Grahame equation establishes that;

$$\sigma = \sqrt{8\varepsilon\varepsilon_0 k_B T} \sinh(e\psi_0/2k_B T) \times \sqrt{M_{1:1}}$$

1.2

where $M_{1:1}$ define the molar concentration of the substance.

Consequently, it should be further pointed that equation 1:2 could be used to determine the range of electrostatic double-layer interactions in terms of surface thickness of the diffusion atmosphere (of the counter ions to the surface charges). This double-layer interaction imposes an entropic effect which arises due to decrease in the thickness of the liquid film (composed of the dissolved ions). Thus, attractive forces between the dissolve ions and the opposite charges on the surfaces stabilizes the ions and upon increased electrolytic concentration, osmotic repulsion arises between the molecules, thus resulting definite range of molecular shapes for the material in question. The energy dissipations arising from these interactions (attractive or repulsive) are directly linked to van der Waals relativities and dielectric properties [4].

It is the position of this paper that molecular interactions in response to external conditions require a manipulation of this k^{-1} factor; which in this paper was been stated to be achieved by +ve M_i and +ve z_i variabilities; for which an additive variability results the relation;

$$V_A = \sigma \, (M_i z_i) \ \text{x} \ (M_{\alpha\,:\,\alpha})^{1/2} \qquad\qquad 1.3$$

If equation 1.3 relates to a diatomic potentiation, then an aggregated approach thus implies a modular framework of a nanostructure which, as pointed earlier is scalable and integrative. Thus, the structural mechanics of such aggregated molecular framework of supporting materials hence depends on:

a)   atomic and intra atomic relativities which results molecular and intra-molecular replications.

b)   interaction energies and forces in the case of bonding orbital of integrated materials.

c)   unstable molecular geometrics resulting from combined oscillating and translational vibrations.

III.   III SURFACE POTENTIALS AND THE FULL FORCE LAW- Relevance in Molecular Manufacturing

In molecular manufacturing conditions, the full force law implies that ionization complexes and molecular surface potentials influences and affects the structural orientation and mechanics of the combing nanomaterials, thus resulting nano-machines and nanofabricated devices whose operational capability is a direct response to the manipulation of these surface properties and complexes. As the following expressions and tables indicates, *interaction energy* and *forces of cohesivity* are critical factors to consider when determining molecular surface complexes.
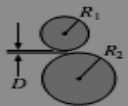
Two spheres or macromolecules of radii R_1 and R_2	$R_1, R_2 \gg D$	$\left(\frac{R_1 R_2}{R_1+R_2}\right) Z e^{-\kappa D}$	$\kappa \left(\frac{R_1 R_2}{R_1+R_2}\right) Z e^{-\kappa D}$
Molecular energy and force relativities in macromolecular interactions	a_i: Geometry of molecular radii with surfaces D apart (D< <R)	a_{ii}: Interaction Energy E between Molecules of radii R_1 and R_2	a_{iii}: Interaction Force, F between Molecules of radii R_1 and R_2

Table 1: Two spheres or macro molecules of radii R_1 and R_2 indicating surface energy and force relativities

In Table 2 below, the interacting energy and forces constituting the full force law are shown to maintain steady state equilibrium due to the structured orientation of molecular surface forces and potentials of the interacting molecules; thus creating and sustaining the stability between the two parallel nanorods. This can be better referred to as the mechanics of molecular coercivity.
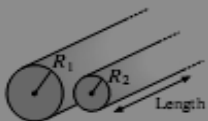
Two parallel cylinders or rods of radii R_1 and R_2 (per unit length)	$R_1, R_2 \gg D$	$\frac{\kappa^{1/2}}{\sqrt{2\pi}}\left(\frac{R_1 R_2}{R_1+R_2}\right)^{1/2} Z e^{-\kappa D}$	$\frac{\kappa^{3/2}}{\sqrt{2\pi}}\left(\frac{R_1 R_2}{R_1+R_2}\right)^{1/2} Z e^{-\kappa}$
Mechanics of molecular energy and force relativities	b_i: Mechanics of molecular radii interaction in the form of nanorods with $R_1, R_2 \gg D$	b_{ii}: Interaction Energy E between rods of radii R_1 and R_2	b_{iii}: Interaction Force, F between rods of radii R_1 and R_2

Table 2: Two parallel cylinders or nanorods of radii R_1 and R_2 indicating the mechanics of molecular coercivity.

It should be noted that, studies have shown that where intermolecular positions are established based on separations defined by distance *D,* there are consequential presence of other complex forces implying that the "full force law" between two surfaces or colloidal particles as suggested by the *Derjagiun-Landau-Verway-Overbeek* (DLVO) Theory [5, 6] is far more extended. This paper is of the firm view that these forces do not only exist as "*i-factors in ith dimensions*", they directly and indirectly influence molecular conditions and reactivity; implying that these forces also interact, overlap, repel, subsume or support. Thus, the complexity of the totality or energy potentials resulting from the "full force law" as described above weigh far beyond the primary van der Waals forces resulting from electrostatic interactions. This means that the Maxwell relativity:

$$\nabla \times \mathbf{E}(\mathbf{r}, t) = -\frac{\partial}{\partial t}\mathbf{B}(r, t)$$

1.4

that is established where these charges are found is also suggestive of the presence of electrostatic and quasi-electrostatic fields *[E(r,t)]* with complex magneto-optic frequencies *[B(r,t)]* and this characteristically define the behavioral mechanics of nanomaterials and by extension define their specific properties and use to which they could be deployed [7].

Further, the DLVO theory indicates that localized multiple minima and maxima potentials exists between force barriers for which primary and secondary minimum can be achieved by varying the concentration of the particulate materials resulting *reversible flocculation* or *irreversible coagulation*. The import of these propensities is the relative fact that at certain potentials, double-layer interactions could be observed to be attractive, and this occurs in situations of like or similar charges due to dissociation of chargeable groups on the surface. This means a layer exist where attractive or repulsive forces regulate surface distances and potentials and under the same condition, another layer exist with mixed charge conditions; implying complicated bonding conditions which polarize the inter-molecular structure and thus define their shapes and utilization possibilities. In the view of this paper, the identified *quasi-bivariant constraints* imposed on the structure of the molecules are characteristic of their relative applications in nanoscale design. In support of this argument, Atkins [8] used the wave function parameter of a hydrogen molecule to indicate that;

$$\Psi \sim 1S_A + 1S_B$$

1.5

Thus, equation 1.5 apply at instances were diatomic and polyatomic considerations impose restrictions on the possible shapes of the macromolecule, for which structure of hydrogen molecule with two atoms $1S_A$ and $1S_B$ overlap each other in the bonding condition as shown in the understated geometric consequence, as in figure 1 below: [8]
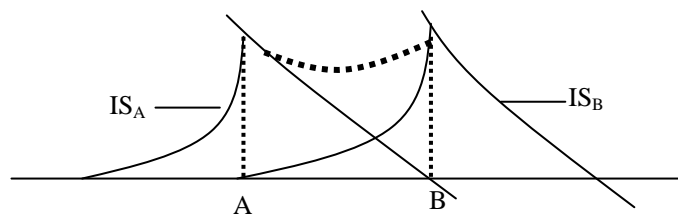

Figure 1 orbital overlap in bonding conditions indicating double-layer structural configuration and force barrier/ buffer zone

In view of this schematic, Atkins observed that since a molecular orbital is the product of the building blocks of atomic orbitals (or a linear combination of atomic orbitals, L.C.A.O. procedure); this postulation imply that equation 1.5 is only an approximation of an exact orbital condition which spreads through the whole molecular framework of the molecule. As indicated earlier, the DLVO theory is a complicated molecular structure with double-layer and force barrier configurations [9] as in figure 2 below.
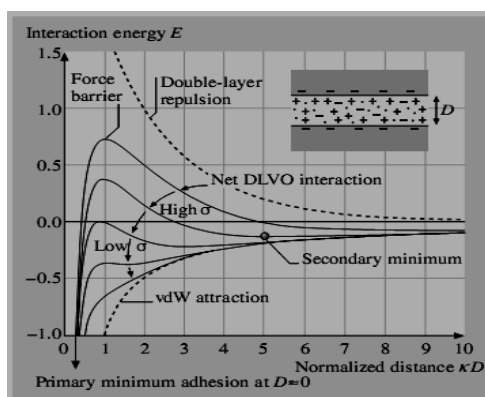

Figure 2 DLVO energy profile diagram indicating low, high and net DLVO interactions including repulsion forces made of like charges and attraction forces due to mixed charges condition. The buffer zone as shown in broken lines is seen to encapsulate the energy-force interaction profiles. Notice that the energy-force intensity of this zone diminishes as the k^{-1} factor approaches infinity. The consequence of this finding is that energy-force interactions are dependent on the value of D; which varies between elements and thus forms the basis for structural differences in molecules of various engineering materials and also account for the types and nature of application to which the materials can be deployed.

The forgoing notwithstanding, this paper observes that molecular manufacturing conditions requires a correlation between factors producing and enhancing strong layering (i.e. mixed charge conditions) and those that produce and sustain strong in-plane modulations, (i.e. same charge proclivity) [10]. It should be noted that the identified factors produces varying structural dimensions and lengths which studies have shown results conflicts which frustrates attempts to explain polar orientation of charges by offering complicated layering and in-plane order [11], [12] and [13]. Thus, difficulties encountered in molecular manufacturing majorly concern these complicated conditions of the point of molecular orbital overlap (by extrapolation of figure 1 into intended molecular bonding conditions). This condition is responsible for the bivariant potentials and complexes encountered during nanostructural analysis of materials for suitability and utilization in the manufacturing of nanodevices and nanomachines, mostly applied in high precision, quality control in-plant nanosensors and scanners.

IV.   RESULTS

As observed, the frustration indicated above imposes a limitation on the utilization of surface potentials and properties of engineering materials in nanoscale applications and nano manufacturing activities. In order to overcome this situation, the approximation identified above can further be expanded to accommodate other *factorial conditionalities* that must be contained in order to diversify applications resulting from the understanding of the opportunities available with the control and manipulation of the surface potentials of molecular orbital. Thus, ability to control or manipulate these observed quasi-bivariant molecular conditions implies increased capacity utilization of molecular manufacturing technologies.

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