Atomic Structure and Binding of Carbon Atoms

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Abstract – Many studies discuss carbon-based materials because of the versatility of the carbon element. They present different sorts of understandings fairly at convincing and compelling levels. A gas state carbon atom converts into its various states depending on the conditions of processing. The electron transfer mechanism in the gas state carbon atom is responsible for its conversion to various states namely, graphite, nanotube, fullerene, diamond, lonsdaleite and graphene. The shape of energy responsible to transfer electron from the sides (east- and west-poles) of its atom is like parabola that is linked to states where exerted force to relevant poles of transferring electron (from filled state to nearby unfilled state) is remained neutral. So, the mechanism of forming different states of a gaseous carbon atom is under a bit non-conserved involving energy, which is not the case for atoms executing their confined inter-state electron-dynamics. Structure evolved in graphite, nanotube and fullerene states have one-dimensional, two-dimensional and four-dimensional atoms, respectively, and the associated energy curve is like parabola indicating transfer of electrons under neutral exertion of forces to their relevant poles. The graphite structure under only attained-dynamics of atoms is also developed but in two-dimension where engaged binding energy between them is under an influence of a small difference between involved forces of their opposite poles. Structural evolution in diamond, lonsdaleite and graphene atoms involve potential energy of electrons required to undertake infinitesimal displacements under orientationally-controlled exerting forces to their relevant poles. In this study, the growth of diamond was found to be from south to ground in which the atoms were bound in ground to south indicating tetra-electrons ground to south topological structure. Lonsdaleite showed a bi-electrons ground to just-south topological structure. The growth of graphene was just-north to ground; however, the binding of atoms was ground to just-north showing tetra-electrons ground to just-north topological structure. Glassy carbon exhibits layered-topological structure which successively binds tri-layers of gas, graphite and lonsdaleite state atoms in the repetitive manner. In this case, pair of orientated electrons of gas atoms and lonsdaleite atoms in their layers take another clamping of pair of unfilled energy knots by entering from the rear-side and front-side, respectively and to bind to intermediate layers of graphitic carbon atoms. Different carbon atoms develop amorphous structures when they bind under frustrating amalgamation. Hardness of carbon-based materials was also sketched in the light of different force-energy behaviors of different state carbon atoms. Here, structure evolution in each carbon state atom explores its own science.

Keywords: Carbon; Atomic structure; Force-energy; Atomic binding; Structure

1.0 Introduction

Developing materials of selective size and shape and investigating their characteristics for various applications solicit new sort of approaches and observations. The forces appeared at electron-levels involve the process of structural modification which involve energy changes and vice versa. The engagement of neutral forces or orientationally-controlled exerting forces at electron-levels is because of the execution of their dynamics under involved energies where their atoms belonging to certain carbon allotropes should also be considered under the partially confined partially non-confined inter-state electron-dynamics or non-confined inter-state electron-dynamics, respectively. The force and energy of the atoms are to be considered in partially conservative mode in the first case and in the non-conservative (frictional) mode entirely in the latter case. Engaging (or involving) energy to involve (or engage) force for evolving structure of different format solid-natured atoms is to be considered as per their built-in gauge of electron-dynamics. Here, the word “involve” refers to an action of energy or force for “instant time”, whereas, the word “engage” refers to an action of energy or force for “eternal period” nearly. When carbon atoms of gas state are converted into its certain state eligible to evolve structure, they are expected to evolve structure under the involvement of energy first instead of the force first. As the electrons of outer ring are eligible to execute dynamics where they are sufficiently close to electrons of zeroth ring and for any state of the carbon atom. So, electrons of zeroth ring don’t permit force to appear for relevant poles to transferring any of the electron to any of the unfilled state belonging to outer ring (first ring). This results into involve the energy first for transferring electron to nearby unfilled state instead of the force first. However, when conservative forces exerted for neutral state silicon atom, an uninterrupted execution of electron-dynamics results into wave like heat energy [1]. This indicates that the built-in gauge of electron-dynamics in the case of carbon atom is different as compared to silicon atom despite of the fact that the same number of filled states and unfilled states are available in their outer ring. But the distance of each electron of outer ring from the center in carbon atom is different as compared to silicon atom [2]. So, silicon atom executes confined inter-state electron-dynamics instead of non-confined (or partially confined) inter-state electron-dynamics. The atoms at different levels involve conservative forces where confined inter-state electron-dynamics are executed, which evolve the structures in different manner [3]. This approach based on the multidisciplinary point of view may originate understandings of a different atomic nature and behavior which could be very different from the existing literature.

It is also important to know that the atomic structure of carbon and binding of the different carbon states atoms along with atoms belonging to any element don't ionize [4]. Understanding the mechanism of evolving structure based on the different carbon states rely on same chemistry at input end. Various spectroscopic analyses of a 'tiny grains carbon film' give peaks at different positions indicating different carbon states/structures [5]. In addition, depending on the conditions and the techniques involved, gas carbon atom-source works for the development of different morphology and structure of grains and crystallites [6]. Also, different morphology of grains and crystallites (particles) was observed at different chamber pressure identifying the role of arresting energies near to/at substrate with different rate for each resident chamber pressure [7]. Moreover, the deposition of graphite and diamond in distinctive manner at single substrate is due to the different set inter-wire distance of dissociating gases [8].

Carbon atoms having different states are known as allotropes i.e., starting from the gas state carbon atom to graphite state, then, diamond, lonsdaleite carbon, fullerene followed by nanotube state, glass carbon, and recently, the graphene. Several studies on carbon-based materials are available in the literature explaining the conditions of deposition and their effects in the form of morphology, growth rate, quality and application, etc.

It is necessary to understand the dynamics of development of tiny particles prior to go for assembling them into large-sized particles [9]. Agglomerations of colloidal matter envisage atoms and molecules to deal them as materials for tomorrow [10].

Developing of different features tiny particles have been discussed elsewhere [11]. The developing mechanism of tiny-shaped particles under certain concentration of gold precursor has been discussed [12]. Under identical process parameters, the nature of precursor directs tiny-shaped particles following by the development of their large-shaped particles where role of the required atomic nature was also in focus [13]. Different tiny particles following by large-sized particles were developed under the application of nanoshape energy while varying the bipolar pulse and pulse polarity [14]. Developing large-sized particles shows very high development rate [15]. Developing monolayer tiny-shaped particle under the application of nanoshape energy was discussed where atoms of one-dimensional arrays are converted into structures of smooth elements [16]. Certain nature atoms of tiny-sized particles undertake different behaviors resulting into work as either effective or defective nanomedicine [17]. Gold particles of unprecedented shapes have been developed under tailored conditions of processing solution [18]. Hard coating of certain gas- and solid-natured atoms developed because of their established transitional force-energy behaviors [19].

Atoms of different elements and then structures are recognized by their physical behavior. A carbon atom shows several physical natures even though exhibits the distinctive chemical nature. Different carbon-based materials possess atoms of same recognized chemistry but indicate a very different behavior with respect to each other categorized clearly [5-8]. This indicates that the transition of electrons within designated states to nearby unfilled state (within the same ring) change the chemical nature of atom resulting into a new state of physical phenomenon. In gas- and solid-natured atoms of suitable elements, transitions of electrons can’t cross the north-pole or south-pole of their atom, but they do cross their own projected north-south poles to develop liquid transition state [2]. It is also observed that the force entering (north-pole) and leaving the ground surface (south-pole) is different as compared to force at/near ground surface (east-west poles) [20]. Thus, the available option for transferring electron of filled state to unfilled state in all suitable atoms is left at left-side or right-side of their atoms. So, the available option for transition of electrons in gaseous or solid atoms (belonging to the suitable elements) is only within the clamped energy knots where they undergo established transition states namely, recovery, neutral, re-crystallization and liquid states depending on the rate of their infinitesimal displacements. The center of each atom is related to null exerting forces of different poles as it is declared as the common point of inter-crossed overt photons having no mass of the electrons [2]. When the ground point of an atom is above the ground surface, as in the gas state, the dominating force is considered to be based on the space format. When the ground point of an atom is below ground surface, as in solid state, the dominating force is considered to be based on the grounded format. When the ground point of an atom is at average-leveled ground surface, as in partial solids, the dominating force is considered because of surface format. Evolution of different dimension structures in atoms of nearly (semi) solid structures, solid behavior and highly solid behavior at just above ground surface, at ground surface and at below ground surface, respectively, envisage different format of exerting forces at electron-levels [3].

Binding of atoms in different state showed that the carbon atoms remained challenging since the discovery and only partial information on evolution of graphite structure is available. In addition, atom to atom binding of carbon in diamond remained challenging as, on one side, a large crystallite (particle) is growing and, on the other, a single atom of diamond deposited on it for further growth. Then, origin of structure in other carbon states as well as evolution of structure comprising layers of certain state carbon atoms in a repeated order remain challenging. In the present work, atomic structure of different carbon states is pinpointed along with structure evolution of all possible carbon states. This study describes the science of originating different carbon states and their structure evolution.

2.0 Results and discussion

The lattice of a carbon atom; Figure 1 (a) shows four unfilled states (energy knots) at the center which are related to the zeroth ring, whereas, eight unfilled states (energy knots) around the zeroth ring are related to outer ring (first ring). Each energy knot is formed by the precise inter-crossing of the overt-photons having certain length where the trough of one is in-front of the crest resulting into freeze (jam) the element of their force. Two pairs of overt-photons having wavelength of current when inter-crossed by keeping their common center (comprising each pair of four troughs and four crests), states of eight electrons formed by the resulted eight hollow regions where the element of their force remains intact along with the shielded energy. Those two pairs of photons (having characteristic of current) inter-crossed (at the same center) along north-south axes compress two states (energy knots) of their opposite sides by means of already inter-crossed double pair along east-west poles. This results into the hollow regions for only four states of electrons as shown in Figure 1 (a). Pairs of certain length overt-photons inter-crossed to form the states of clamping energy knots of twelve electrons under their common center. Among twelve states of electrons, central four are related to zeroth ring and outer ring of eight sites form the first ring where four remained filled and four remained unfilled, thus, providing the option to originate six different state behaviors of a carbon atom in addition to the gas state. In Figure 1 (b), a gas state carbon atom is shown and remaining different states of a carbon atom are shown in Figure 1 (c-h) where the positions of electrons belonging to the outer ring are changed accordingly; in (c) graphite state, (d) nanotube state, (e) fullerene state, (f) diamond state, (g) lonsdaleite state and (h) graphene state carbon atoms are shown. For each different state carbon atom, the central four electrons form the zeroth ring, which is termed as nucleus and is a helium atom [2].

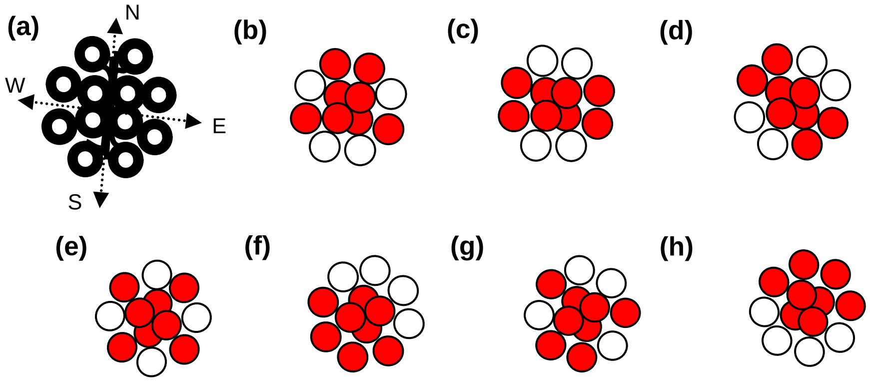

Figure 1: (a) lattice of a carbon atom, atomic structure of carbon atom when in (b) gas state, (c) graphite state, (d) nanotube state, (e) fullerene state, (f) diamond state, (g) lonsdaleite state and (h) graphene state; filled red colored circles indicate filled states, filled white colored circles indicate unfilled states and black colored rings indicate clamping energy knots to states; drawn in estimation

When a gas state carbon atom is processed to transfer two electrons of filled state to nearby unfilled state, one from the right-side and one from the left-side for one state migration, it involved energy shape-like built-in gauge of the electron-dynamics where exerting forces of relevant poles to those electrons remain neutral. Thus, a transferring electron obeys the exact trajectory of bound energy to energy knots of filled and unfilled states. Each binding energy plot will have shape-like parabola for each transfer of electron, one from the east-side and one from the west-side of the atom, enabling conversion of gas state carbon atom into graphite state. In

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transferring all four electrons of outer ring to unfilled states available below to east-west poles (central line) in gas state carbon atom, three pairs of energy plot have shape-like parabola involved, which results to convert it into a diamond state carbon atom. The applied forces on relevant poles for transferring electrons to each dedicated state of their atom remained neutral.

When gas state carbon atom converts into graphite state, it is under the availability of energy shape-like parabola where certain electron of left-side and certain electron of right-side are transferred by the neutral behaviors of forces applied for them. The exerted forces are related to the space format and surface format, which are kept neutral at the instant for transferring electrons because of the blockage of electrons belonging to zeroth ring of that carbon atom. However, transferring requires electrons of graphitic carbon atom for lonsdaleite state carbon atom, an energy plot having parabola like shape along west to south and an energy curve-like parabola along east to south are involved where the neutral behaviors of exerting forces for them are also engaged. But, exerted forces for transferring of electrons are related to surface format and grounded format. In conversion of lonsdaleite carbon state from graphite state, only two electrons are transferred to dedicated states under typical energies. But, on conversion of diamond state atom from lonsdaleite, two electrons are transferred further to dedicated states under involved energies. At that instant, ground point of the diamond state carbon atom became further below to ground surface as compared to lonsdaleite carbon atom as it possesses ground point at just below the ground surface. Transfer of all (four) electrons of outer ring toward south-pole in a carbon atom, two from the left-side of south-pole and two from the right-side of the south-pole, results into ground point of the carbon atom to become fully grounded, which is related to diamond state carbon atom. Thus, the electron transferred undertakes the maximum potential energy, which is being maintained under the exertion of orientating gravitational force to the maximum extent where clamped energy knots to electrons possess the maximum expansion also.

Due to the very small distance of outer ring from the center of carbon atom, exerting forces of east and south poles, east and north poles, west and south poles and west and north poles for transferring a filled state electron to nearby unfilled state, in each case, become almost equal. Thus, energy shape-like parabola regulates it for the entire trajectory forming between filled to nearby unfilled state. So, the relevant forces exert neutral while transferring electrons of opposite sides in carbon atom and under the involved set of typical energies. Therefore, that carbon atom originates a new state behavior under the maintenance of equilibrium. Under the maintenance of equilibrium, transferring electrons of outer ring in graphitic carbon atom converted it into fullerene state carbon atom. A gas state carbon atom converted into nanotube state carbon atom. But, a fullerene state carbon atom can be converted directly into nanotube state under the supply of two unit-energy shape-like parabola. A graphitic carbon atom is converted into diamond state, lonsdaleite state and graphene state carbon atom, one by one, under the supply of different number unit-energy shape-like parabola where the exerting forces to electrons do not disturb them to follow the trajectory as they remain neutral for all poles of an electron. Energy knots forming the unfilled and filled states of the carbon lattice expand or contract to different extent depending on the position of electrons belonging to the outer ring.

An occupied or unoccupied position of electron in the atom is termed as ‘state’. Based on newly occupied state of the electron, a new allotrope of its carbon atom is also termed as ‘state’ but in this case, the atomic state instead of electron state, which is also belong to the carbon element. Depending on the electrons attained positions in their carbon atom, the contraction and expansion of clamped energy knots are adjusted accordingly and, then, relatively to the neighboring ones.

In Figure 2 (a), binding of graphitic carbon atoms is shown; where one amalgamated atom is already in the graphite state (atom A) and another (atom B) is in the transition to attain the graphite state. At that instant, energies involved for transferring the electrons of filled states to the ones for attaining graphite state of that carbon atom is also utilized for bind. Thus, graphite state carbon atoms bound adjacently along the same axis. However, that energy was absorbed (or linked between states) prior to transfer of an electron where it follows its trajectory having shape-like parabola to attain the graphite state where role of the engaged forces (in both space format and surface format) remained impartial (unbiased/neutral). Thus, the atom B bound to atom A while converting to graphite state. Binding of atom B to atom A involved typical energies having plot shape-like parabola result in the graphite structure by the repetition of the same scheme. In the binding of carbon atoms in graphitic carbon atoms, the energy involved is also protected by the neutral behavior of applied forces as the shape of typical energy and its connections between nearby relevant energy knots do not affect. The applied neutral behavior of forces in binding atoms in graphite remain along the same axis as shown in Figure 2 (a), thus, developing graphite structure in one-dimensional. In developing graphite structure under the execution of electron-dynamics of atoms, their binding remained along the single direction of X-axis. Under the execution of electron-dynamics, this one-dimensional structure evolution in graphitic carbon atoms can be in the single direction of opposite-side of X-axis. Atoms of such one-dimensional arrays while evolving their tiny grains elongated under the exertion of surface format forces to convert them into structures of smooth elements [5].

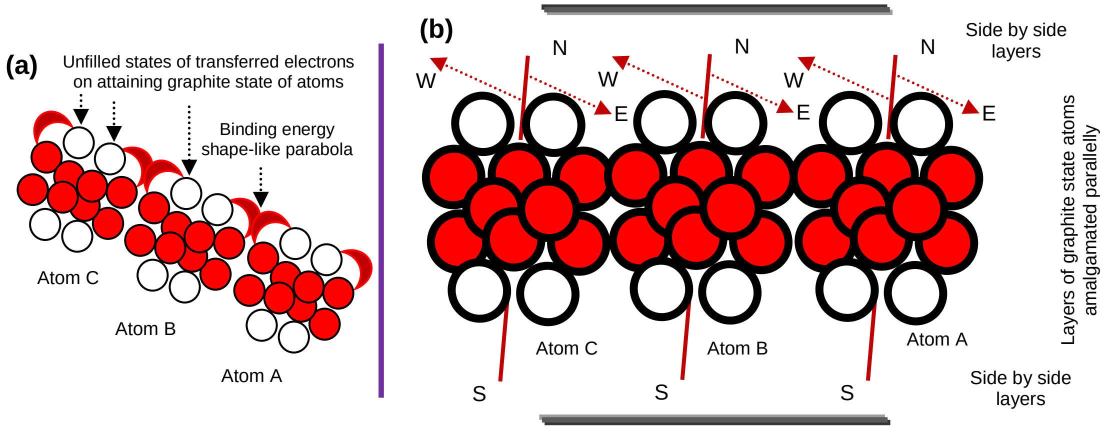

Figure 2: Structure evolution in graphite state carbon atoms (a) when executing electron-dynamics under suitable amalgamation, they evolve a one-dimensional structure and where (b) amalgamated atoms engaged forces only under the attained dynamics, they evolve a two-dimensional structure

When atoms amalgamated under preserving their graphite state, they only bound under the attained dynamics to evolve structure without the execution of electron-dynamics. At this stage, the evolving graphite structure becomes two-dimensional. The typical parabola like energy curve remains no more involved in binding graphitic carbon atoms. Based on the slight difference in exerting east-west forces at point of amalgamated two graphite state atoms to central one, they remain bound only under attained dynamics, Figure 2 (b). When identical layers of graphite state atoms are developed side by side (parallelly) to that layer, upward-side and downward-side (or only for one side), that graphite structure undertakes two-dimension as the force difference along other poles also contributes. Even though existing forces of opposite poles don’t work for an appreciable difference to allow binding of graphite state carbon atoms, but, they, also don’t allow atoms to go away from each other.

Under the opposite poles' forces of east-west, graphite state carbon atoms adjust along both directions of X-axis where they amalgamate adjacently.

When the surface of evolving graphite structure is not flat at electron-level, the influences of exerting north-south forces are also included where developing structure of graphitic carbon atoms is related to amorphous graphite structure. The evolution of amorphous structures may be considered in the case of other states of carbon atoms where frustrated attained dynamics of atoms can distort evolving structure of a certain state carbon atoms. Uneven surfaces for developing the first layer utilize the forces of north-south poles under non-uniform distribution resulting in maintaining developed amorphous graphite structure.

A nanotube state carbon atom converted from the fullerene state carbon atom prior for assembling was under the neutral forces while transferring electrons. Therefore, transferring electrons for each unfilled state is also under the involved energy shape-like parabola. Here, the execution of dynamics of electron is neither under non-conservative force nor under conservative force but under partial conservative force as the energy curve shape-like parabola was the trajectory of transferring electron for required state. Carbon atom of nanotube state evolves structure based on the involvement of binding energy for atoms attaining the identical state at instant of amalgamating, Figure 3 (a). Here, a fullerene state carbon atom converts into a nanotube state carbon atom on transferring electron to nearby unfilled state for each opposite quadrant. Atoms of such carbon state bind under the neutral behavior of exerting forces to electron in surface format and space format for one quadrant and exerting forces to electron in surface format and grounded format for the opposite quadrant. In the case of structure of nanotube evolution, atoms of nanotube state executed their electron-dynamics in two opposite quadrants where neutral behavior of forces exerted also while transferring electron to dedicated state. The energy shape-like parabola is involved to transfer electron of a particular state, from south-side and north-side in the opposite quadrants of atom resulting in binding amalgamating atoms at both sides, Figure 3 (a). The binding of atoms in nanotube structure have two opposite quadrants, in either way, the evolution of structure is related to two-dimension, but the overall shape of nanotube appears in one-dimensional shape, which is shown for two options in Figure 3 (a).

A carbon atom attains fullerene state by the transfer of electron at each dedicated state of pole while engaging the energy shape-like parabola for all four quadrants where transferring electron of each quadrant engages neutral behavior of exerting forces of relevant poles. Here, a contribution of applied neutral force of space format for two quadrants along with surface format and a contribution of exerting neutral force of grounded format for two quadrants along with surface format is to be considered. A characteristic energy shape-like parabola while binding of identical state atoms at point of executing electron-dynamics is shown in Figure 3 (b); where the evolution of fullerene structure in two different ways is shown. This indicates that the structural evolution in fullerene state carbon atoms is four-dimensional. Binding of fullerene state carbon atoms to evolve fullerene structure for all four quadrants of nearly plane surface forming angle either at nearly mid of each quadrant or at nearly along north-south poles and east-west poles. A fullerene state carbon atom converts from the nanotube state carbon atom before assembling where exerting forces of relevant poles at the time of transferring electrons remain neutral and only the involved energy transferred them to dedicated states. In the fullerene state carbon atom, upper-sided transferred electrons engaged the neutral forces in space format and surface format while lower-sided transferred electrons engaged the neutral exertion of forces in grounded format and surface format.

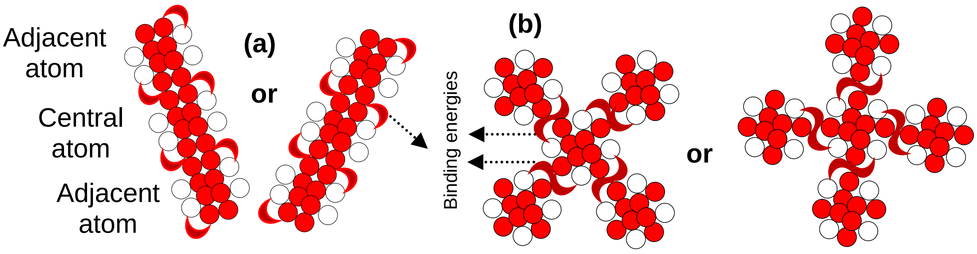

Figure 3: (a) nanotube structure – a two-dimensional structure where the involved energy shape-like parabola in opposite quadrants of targeted atom binds amalgamated atoms at left-side and right-side and (b) fullerene (buckyballs) – a four-dimensional structure where the energy shape-like parabola involved in each quadrant of targeted atom binds four amalgamated atoms

A lonsdaleite state carbon atom having ground point just below ground surface is shown in Figure 4 (a), approaching to bind to the diamond state carbon atom once it is converted into a diamond state carbon atom. A diamond state carbon atom, which has already attained ground point at sufficiently below surface, is also shown in Figure 4 (a). The expected binding point of atoms when both are binding in diamond state is also shown in The Figure 4 (a). In the nucleation of synthetic diamond, a deposited atom is at highly heated scratched seeded surface of solid which doesn't allow it further to attempt gravitation behavior of electrons because of having the maximum potential energy under orientationally-controlled exerting forces of fixed poles, therefore, no more expansion of clamped energy knots takes place. So, those electrons don't intrude further their resting surface even to the extent of size (mass) of an electron resulting to maintain the diamond state of their atom. Thus, that diamond state carbon atom shows solid behavior at maximum extent. Therefore, the ground point of diamond state carbon atom is at sufficiently below ground point of lonsdaleite state carbon atom which is a bit below to ground surface. In this context, lonsdaleite state carbon atom is in less expansion of clamped energy knots to filled and unfilled states forming its lattice as compared to ones in diamond state carbon atom. In Figure 4, sketches of different entities are drawn in estimation to show less and more expansion of clamped energy knots to filled and unfilled states of carbon state atoms.

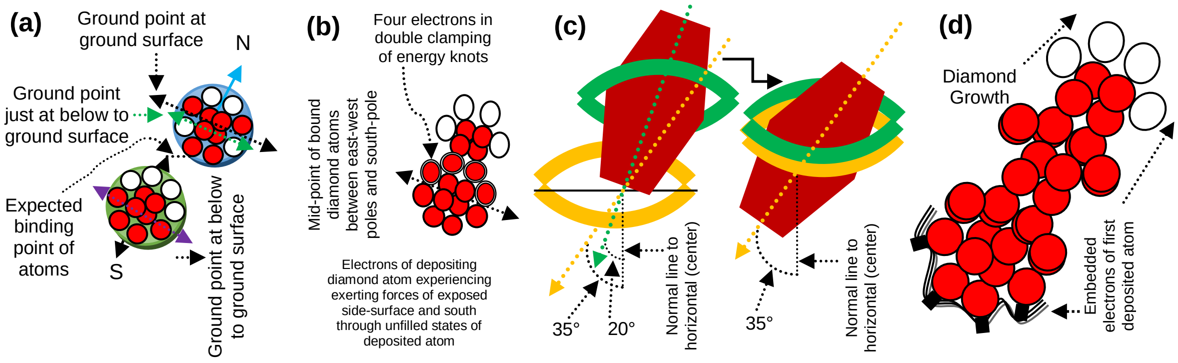

Figure 4: (a) ground points of lonsdaleite and diamond state carbon atoms along with the expected binding point of two diamond state carbon atoms, (b) depositing diamond state carbon atom when four electrons of outer ring undertake double clamping of energy knots under experiencing the forces of side-surface and south poles where they rightly located above the four unfilled states of deposited diamond state carbon atom, (c) orientation of certain electron of lonsdaleite state carbon atom, prior to conversion and orientation, when it undertakes conversion into diamond state carbon atom where clamping another energy knot belonging to certain unfilled state of deposited diamond state carbon atom and (d) growth of diamond is south to ground; red colored circles indicate filled states, white colored circles indicate unfilled states and red colored double-circles indicate electrons of double clamping of energy knots.

The ground point of lonsdaleite state carbon atom is just below the ground surface because, it is underneath to ground point of graphitic carbon atom. In diamond state carbon atom, electrons are in their maximum gravitation behavior where expansion of clamped energy knots also come to the maximum extent. The resulted energy against the work done of electrons in diamond state carbon atom dissipated enabling expansion of clamped energy knots to the maximum extent. Electrons of lonsdaleite state carbon atom exert orientational force at lower degree angle from the normal line of their center resulting into possess lower amount of potential energy, hence, their clamping energy knots are in lesser expansion.

On the transfer of left two electrons to downward-side unfilled states, lonsdaleite state carbon atom is converted to the diamond state carbon atom. Now, electrons of that converted diamond state carbon atom also undertake the same level of expansion in terms of clamped energy knots as in the case of targeted (deposited) diamond state carbon atom. On the other hand, just grounding diamond atom on deposited diamond atom, a controlled expansion of clamped energy knots in both diamond state atoms are being monitored under the application of orientationally-controlled exerting forces of relevant poles of electrons (in surface format and grounded format). This results into undertake targeted electrons for another clamping of energy knot, in each case, through targeted unfilled states of already deposited diamond state carbon atom where they experienced the exerting force of relevant poles while arriving rightly over them (targeted unfilled states). Each electron of filled states belonging to outer ring of depositing diamond state carbon atom undertakes another clamp of energy knot of unfilled states belonging to outer ring of deposited diamond state carbon atom resulting into their binding as shown in Figure 4 (b). On binding diamond state atoms, their combined filled and unfilled states along with zeroth rings adjust and compensate both expansion and contraction behaviors by constructing new binding point for the following depositing diamond state carbon atom.

Lonsdaleite state carbon atom undertakes less expansion of energy knots clamping electrons and vacant sites as compared to the diamond state carbon atom. Therefore, a lonsdaleite state carbon atom is more related to the recovery state of an atom where orientation of exerting force to each electron clamped by energy knot becomes ~20° angle from the normal line drawn from its center (270°+20°=290°). Hence, in diamond state carbon atom, expansion of clamped energy knot to electron takes place under the exertion of relevant poles forces at ~35° angle from the normal line drawn from its center (270°+35°=305°). The angles of exerting forces of relevant poles of electrons of lonsdaleite state carbon atom and diamond state carbon atom from their normal line drawn at the center are shown in Figure 4 (c); electron of diamond state when undertook double clamping of energy knot to bind another diamond state carbon atom is also shown, separately at right-side.

Overall growth behavior of diamond state carbon atoms is shown in Figure 4 (d); where binding of diamond state carbon atoms remained in-progress under the same mechanism of converting gas state carbon atoms where diamond state carbon atoms adjust and compensate contraction and expansion of clamping energy knots to their electrons each time for binding to new diamond state carbon atom. Therefore, in diamond binding, growth behavior is from south to ground where binding point of the atoms remains between surface format and grounded format. Embedded electrons under suitable mechanism of the first deposited (arrested) diamond state carbon atom is also shown in Figure 4 (d) where they directed themselves ground to south under the maximum expansion of clamped energy knots. At that instant, electrons of depositing diamond atom remain detained in their clamped energy knots. So, when the binding of third diamond state carbon atom is in process, those electrons of second deposited atom are being detained by the unfilled states of first deposited atom to undertake the already clamped energy knot to each of them firmly and precisely. A double clamping to electrons becomes apprehend on adjusting the expansion-contraction of the lattice by those two atoms, which came into force just reaching third diamond state carbon atom on their surface as it locates a new point of binding with respect to already bound two deposited diamond carbon atoms. This will lead the growth process of diamond as shown in Figure 4 (d).

When the depositing diamond state carbon atom reaches precisely over the deposited diamond state carbon atom, two inside electrons of outer ring undertake exertion of force of the pole of outer-side (left-side electron west-pole and right-side electron east-pole) equal to the exertion of force of the south-pole where exertion of the force along the north-pole becomes negligible. On undertaking another clamp of energy knot (belonging to upward-side of deposited atom) by those two electrons (belonging to downward-side of depositing atom), their left outer-sides two electrons also come into the precision to undertake another clamp of left two energy knots of outer-sides as shown in Figure 5. So, the mechanism of undertaking double clamp of energy knot by each electron is first by the inner two electrons following by the left two electrons for both quadrants of the south-pole of binding diamond state carbon atom. Therefore, exertion of one-pole force to outer-side of the electron and one-pole force to tip-side of that electron remains diligent in controlling its position at instant of clamping another energy knot till grounding under the mid half-length to the downward side where only the one-pole force of surface format (exposed side-surface) and south-pole force of grounded format remained operational to undertake double clamping of energy knot. Both energy knots clamped by each electron expanded under disappeared exertion of one-pole force of surface format and north-pole force of space format are shown in Figure 5. In depositing diamond state carbon atom, inner two electrons touch to in-front electrons of zeroth ring, thus, further increasing their potential energy through infinitesimal displacement where orientationally-controlled exerting forces (left-side electron along west- and south-poles and right-side electron along east- and south-poles) result into another clamp of energy knot and, so, for the remaining two electrons as shown in Figure 5.

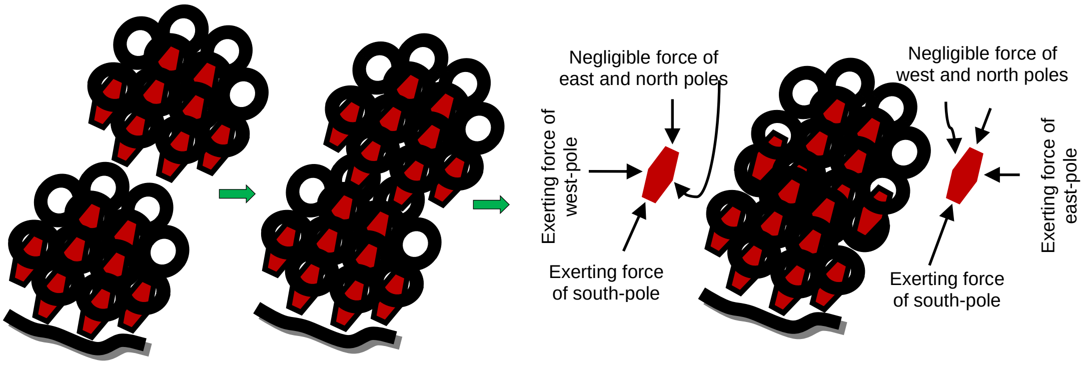

Figure 5: Binding of depositing diamond state carbon atom to the rooted diamond state carbon atom along with exertion of forces to the exposed sides of left-side electron and right-side electron

The mechanism of binding lonsdaleite state atoms obeys the identical process as for the case of binding of diamond state carbon atoms. However, only two orientated (~290°) electrons of lonsdaleite state atom clamp another clamping of energy knot belonging to deposited lonsdaleite state carbon atom. In this manner, one atom dealt the force of just grounded format while the other atom undertook the force of surface format locating a new joint ground point approaching just in the grounded format. Therefore, binding in lonsdaleite state carbon atoms is ground to just-south but growth behavior is just-south to ground. The involved characteristic energy to convert gas state carbon atom into lonsdaleite state carbon atom is in the same shape as for the diamond state carbon atom but in fewer amounts because of transferring of only two electrons along south-pole, at each left-side and right-side.

The ground point of graphene state atom doesn't lie at ground surface, but it lies just at above ground surface. Therefore, graphene state carbon atoms undertake

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contraction of clamping energy knots under exertion of force of electrons where their levitation behavior is at pronounced level. Binding of graphene state carbon atoms includes exerting forces in surface and space formats where binding of atoms is ground to just-north. But, the growth of graphene is just-north to ground. This is the reason why graphene structure is based to only few layers as it is challenging to maintain exerting forces for further elevation. Therefore, in evolution of graphene structure, the binding mechanism of atoms is opposite to the one as for diamond.

One more physical behavior of carbon atoms is resulted when layers of three different states carbon atoms bind in repetitive manner; first layer of gas, second layer of graphite and third layer of lonsdaleite state carbon atoms bind in successive manner. Exerting forces of relevant poles of electrons (belonging to different state carbon atoms ordered in three consecutive layers in repetitive manner) are being kept engaged by their involved (gained) potential energies resulting into the binding of atoms of layers to evolve structure of glassy carbon. Atoms of central layer are belonging to graphitic carbon atoms. Layers of gas and graphite state atoms bind under the joint application of exerting grounded and surface format forces where involved orientationally-controlled potential energies of paired-electrons (of gas state carbon atoms) undertake double clamping of energy knots of paired unfilled states (of graphitic carbon atoms) by directing from their rear-side. Gas state carbon atoms attempted forcefully the gravitation behavior under increased potential energy of their electrons. Layers of lonsdaleite state carbon atoms and graphite state carbon atoms bind under the joint application of exerting space format and surface format forces where involved orientationally-controlled potential energies of paired-electrons (of lonsdaleite state carbon atoms) undertake double clamping of energy knots of paired unfilled states (of graphitic carbon atoms) by directing from their front-side. Lonsdaleite state carbon atoms attempted forcefully levitation behavior under decreased potential energy of their electrons. Layers of lonsdaleite state carbon atoms and gas state carbon atoms provide compensation in terms of expansion-contraction of bound layers of atoms as shown in Figure 6.

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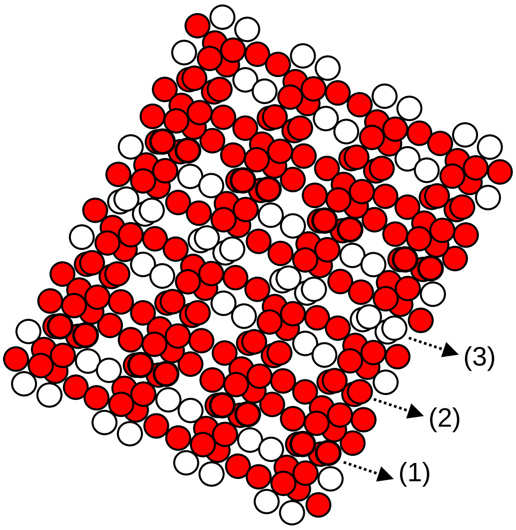

Figure 6: Structure evolution of glassy carbon where tri-layers of gas, graphite and lonsdaleite state carbon atoms respectively bind in the successive manner; (1) paired electrons of each atom (belonging to gas state carbon atoms layer) undertake double clamping of paired energy knots of each atom (belonging to graphitic carbon atoms layer) by entering from the rear-sides, (2) paired electrons of each atom (belonging to lonsdaleite state carbon atoms layer) undertake double clamping of paired energy knots (belonging to graphitic carbon atoms layer) by entering from the front-sides and (3) layers of gas and lonsdaleite state carbon atoms provide compensation in binding their layers to the layer of graphitic carbon atoms

In carbon, electrons of outer ring transfer to nearby unfilled states to originate different state behaviors of their atom. Transferring electrons of filled states to unfilled in the carbon atom involved the non-conserved energy through which non-conservative forces engaged. However, wherever, the conservative forces involved addressing the dynamics of electrons of certain natured atoms, they engaged the conserved energy as well. As, in the case of neutral state silicon atom where a filled state electron is transferred to nearby unfilled state on exerting the conservative forces along relevant poles engaging the conserved energy [1]. This indicates that atomic radius in different elements along with electronic structure of the atom is the core to elucidate what sort of the force-energy behavior is being considered by that atom.

Hardness at Mohs scale for different structures of different states carbon atoms at nanoscale is sketched in Figure 7. No value of hardness is counted when undertaking the gas state carbon atoms as they do not evolve structure at any scale. The hardness scale is related to the binding of different states carbon atoms where involved non-conserved energies due to electron-dynamics engaged their non-conservative forces, which is different for each established state of structure evolution of carbon atoms as noted above. In Raman spectroscopy, different values of wave number printed against energy signals of graphite structure and other structures of carbon (at nanoscale) reveal different nature of propagating photons through different inter-state electron gaps (in their different state carbon atoms), which is validated by the energy loss spectroscopy also [5].

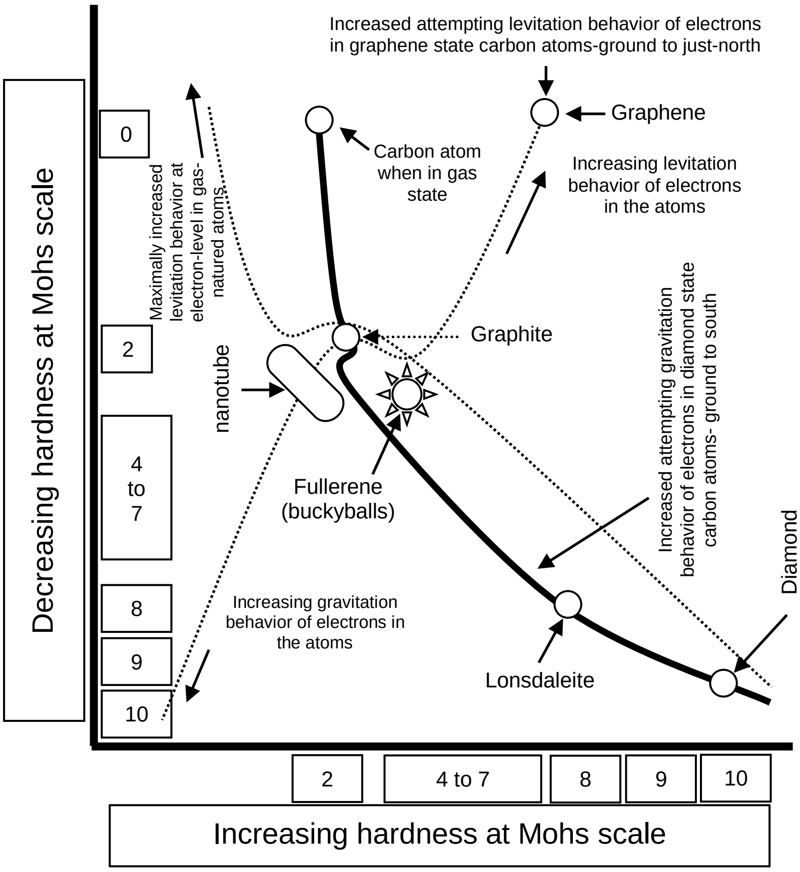

Figure 7: A sketch of approximately estimated hardness (at Mohs scale) of nanoscale structure in different states carbon atoms versus exerting levitational-gravitational force at electron-level

The involving non-conserved energy shape-like parabola in structure evolution of certain state carbon atoms, they work non-ecofriendly also because of involving the neutral behavior of exerting relevant poles forces, which also becomes the cause of non-conservation to environment. A carbon atom enables to understand the nature of electron-dynamics in atoms of different class of elements along with originating new physical behaviors of atoms. And then atoms of which elements involve first force to engage energy and atoms of which elements involve first energy to engage force. Carbon is not an overwhelming material all the times, more fairly, in the case of soft materials involving neutral behavior of forces on binding their atoms. But, it becomes outstanding when it is talked about the basic understanding of electron-dynamics for atoms of different class elements and in the structure evolution of hard carbon-based materials also.

3.0 Conclusions

Two units of energy shape-like parabola enable transferring of electrons from left-right sides to north-south poles of certain state carbon atom while maintaining the equilibrium state where exerting forces in respective format for relevant poles of those electrons work neutral. A carbon atom where two electrons of outer ring occupied sites at both left- and right-sides along the north-pole and remaining two electrons of outer ring occupied sites just below the line of east-west poles, it is related to gas state. In the carbon atom, when two electrons of outer ring retain positions in the states available at just above the line of east-west poles and two electrons of outer ring retain positions in the states available at just below to that line, it is related to graphite state. A carbon atom where all the electrons of outer ring retain positions in the states at below east-west poles, it is related to diamond state.

When structure of graphitic carbon atoms evolves two-dimensionally, it is under the application of attained dynamics only where difference in opposite pole forces in suitably amalgamated atoms regulate the structure. Forces exerting under the difference of poles of amalgamated atoms, if do not restrict them to bind under the engaged energies, at least, they also do not keep them from separating, once they amalgamated under appreciably attained dynamics.

In bindings of graphite, nanotube and fullerene state carbon atoms, the involved typical energy shape-like parabola engages the neutral behavior of exerting forces to relevant poles of transferring electrons, which mainly fall in the surface format. In the case where binding of graphitic carbon atoms is under the execution of electron-dynamics, the evolution of structure is one-dimensional. Carbon atoms when are in nanotube state evolve two-dimensional structure where energy shape-like parabola involved for electrons in opposite quadrants of each atom engaging neutral behavior of exerting forces to their relevant poles. Carbon atoms when are in fullerene state evolve four-dimensional structure.

In bindings of diamond, lonsdaleite and graphene state carbon atoms, the gained energy of electrons undertaking double clamping of energy knots is triggered by the orientationally-controlled exerting forces to their relevant poles. Bindings of diamond state carbon atoms are ground to south, but growth is south to ground where potential energies of orientating electrons engage the controlled behavior of exerting forces to their relevant poles. So, it is a tetra-electrons ground to south topological structure. Bindings of lonsdaleite state carbon atoms are ground to just-south, so, it is a bi-electrons ground to just-south topological structure. Bindings of graphene state carbon atoms follow opposite mechanism to the one for diamond state carbon atoms where potential energies of the orientating electrons engage the controlled behavior of exerting forces to their relevant poles both in the space and surface formats instead of the surface and grounded formats. So, it is a tetra-electrons ground to just-north topological structure.

Repeated sequence of tri-layers (gas, graphite and lonsdaleite state carbon atoms) evolves structure of glassy carbon. In the structure evolution of glassy carbon, the electrons undertaking double clamping of the energy knots are entered from the rear-side (bottom) in the case of layer of gas state carbon atoms and from the front-side (top) in the case of layer of lonsdaleite state carbon atoms. Binding atoms of each layer of lonsdaleite state to atoms of each layer of graphite state is under attempting forcefully levitation behavior of electrons where, because of their decreased (lost) potential energy, they result into undertake another clamping of energy knots. So, the engagement of orientationally-controlled exerting forces of relevant poles to paired-electrons is from the front-side. Binding atoms of each layer of gas state to atoms of each layer of graphite state is because of the attempting forcefully gravitation behavior of electrons where because of their increased (gained) potential energy, they result into undertake another clamping of energy knots. Here, the engagement of orientationally-controlled exerting forces of relevant poles to paired-electrons is from the rear-side.

The neutral forces at electron-levels engage in the formation of structures of graphite, nanotube and fullerene state carbon atoms where partially non-confined partially confined inter-state electron-dynamics executed, whereas, orientationally-controlled exerting forces at electron-levels engage in the formation of structures of diamond, lonsdaleite and graphene state carbon atoms along with glassy carbon where fully non-confined inter-state electron-dynamics executed.

Force and energy work inter-changeably; when force is involved then energy is engaged, but when energy is involved then force is engaged. The matter remains as the intermediate component identifying the functioning of force and energy. To originate the different physical behavior of each state carbon atom, non-conserved energies involve engaging non-conservative forces, so, in the case of their structure evolution. An involved typical energy in developing structures of surface format is non-conserved because it is a sub-part of conserved (discrete) energy of a unit-photon shape-like Gaussian distribution with both ends turned. However, for structure evolutions of diamond, lonsdaleite, graphene and glassy carbon, a transitional potential energy of electrons involved engaging orientationally-controlled exerting forces when double clamping of energy knots is undertaken by them. Each state carbon atom elaborates its own science and, so, in binding of different states carbon atoms.

These investigations lead into present the origin of science and technology at clear grounds opening new areas of research on different lines as compared to the existing ones. These investigations enable one to understand different phenomena related to optics and photonics, certain force-energy behaviors of atoms of different elements, designing of new materials and light-matter interactions along with many others.

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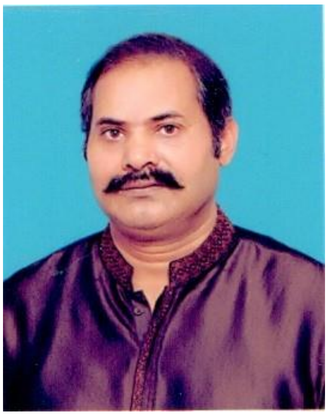

Mubarak Ali graduated from University of the Punjab with B.Sc. (Phys& Maths) in 1996 and M.Sc. Materials Science with distinction at Bahauddin Zakariya University, Multan, Pakistan (1998); thesis work completed at Quaid-i-Azam University Islamabad. He gained Ph.D. in Mechanical Engineering from Universiti Teknologi Malaysia under the award of Malaysian Technical Cooperation Programme (MTCP;2004-07) and postdoc in advanced surface technologies at Istanbul Technical University under the foreign fellowship of The Scientific and Technological Research Council of Turkey (TÜBİTAK; 2010). He completed another postdoc in the field of nanotechnology at Tamkang University Taipei (2013-2014) sponsored by National Science Council now M/o Science and Technology, Taiwan (R.O.C.). Presently, he is working as Assistant Professor on tenure track at COMSATS Institute of Information Technology, Islamabad campus, Pakistan (since May 2008) and prior to that worked as assistant director/deputy director at M/o Science & Technology (Pakistan Council of Renewable Energy Technologies, Islamabad; 2000-2008). He was invited by Institute for Materials Research (IMR), Tohoku University, Japan to deliver scientific talk on growth of synthetic diamond without seeding treatment and synthesis of tantalum carbide. He gave several scientific talks in various countries. His core area of research includes materials science, physics & nanotechnology. He was also offered the merit scholarship (for PhD) by the Government of Pakistan but he couldn't avail. He is author of several articles (https://scholar.google.com.pk/citations?hl=en&user=UYjvhDwAAAAJ,https://www.researchgate.net/profile/Mubarak_Ali5.)