

Forcing or Forced Exertions in Amalgamation of Nanoparticles and Particles inside the Solution

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Abstract: Study of forcing or forced exertions in amalgamating or amalgamated different featured nanoparticles and particles is important for the scientific societies. Observing live dynamics of nanoparticles and particles while their amalgamation inside the solution is a challenging task. It is difficult to discuss amalgamating nanoparticles and particles based on only their visualized dynamics. However, suitably captured microscopic images of agglomerations of nanoparticles and particles can identify different modes of forcing or forced exertions. Nanoparticles and particles, when just at rest positions, amalgamate under resultant difference of exerting forces not only related to poles of occupied quadrant but to poles of their drawn origins also. In this context, colloidal entities amalgamate from their directing sides experiencing a greater force. In amalgamation of nanoparticles and particles, exerting force is successively mute, alert and functioning. Here, energy behavior remains successively in functioning, alert and mute mode. Amalgamation depends on the features and conceived focusing lengths of colloidal entities, which is through the frames of references of exerting forces. In amalgamation of particles in geometrical shapes, electrons of elongated atoms along each side deal with even exertion of force. This is not the case for distorted particles. Colloidal nanoparticles and particles are the best candidates to track nature of exerting forces, so energy behavior also.

Keywords: Nanoparticles; Particles; Forcing exertion; Forced exertion; Suspected point; Focusing length; Amalgamation; Agglomeration

1. Introduction

In order to understand the atomic behavior in different elements, a mechanism of forcing or forced exertion at electron level can be considered. The exertion of force at electron level in atoms of all behaviors is naturally in action [1-7]. This will lead into the understanding of force behavior of nanoparticles and particles while amalgamation inside solution. It is possible to trace (identify, study, disclose, show or map) dynamics of amalgamation of nanoparticles and particles through suitably captured images of microscopic analyses.

Exertion to atom executing confined inter-state electron dynamics involves a conservative mode of force at first stage [1]. A silicon atom under neutral state behavior executes confined inter-state electron dynamics to generate photon energy shape like a wave [2]. For electron transfer mechanism of a gaseous carbon atom, energy and force together convert its state behavior into another state as explored by Ali [3]. However, a conversion of gas state carbon atom to a different state is under the engagement (not involvement) of non-conservative force, which is at second place, where non-conserved energy is involved (not engaged) at first stage. The study conducted by Ali [4] discussed that exerted (engaged) forces for electrons of gas behavior atoms or solid behavior atoms are through the suitable supplied amount of energy, thus, they introduced their different transitional behaviors [4]. Then, atoms of none of the elements ionize [5].

Tiny particles of different features developed through the application of different energy and force behaviors [6]. To nucleate nanoparticles and particles of various geometrical shapes through the coalescences of tiny particles, exerting forces in the immersing format were considered vital by Ali and Lin [7]; exerted forces in the formation of tiny particles at different zones of solution surface were also studied and a source of levitational force has also been explored. Visualizing and observing the atoms at work, their charge dynamics were studied under the application of high-resolution microscopy [8, 9]. Exertions of forces in different manners were discussed in developing tiny particle, nanoparticles and particles of different features [10-14].

The origin of physics and chemistry of materials was discussed, where particles of extended shapes developed at a very high rate [14]. It is important to understand the individual dynamics of formation of tiny particles before studying their assembling for

a large particle [15]. Understanding in assembling tiny particles for a larger sized particles will enable to deal atoms and molecules as materials of tomorrow [16].

The on-going research efforts should use geometry and entropy in addition to structure to explain dynamics [17]. Park *et al.* [18] introduced a method to determine three-dimensional structure of individual nanoparticles in solution as they tend to be a useful means of information. The modification of building blocks to some extent introduced complexity of their self-assembled structures [19]. Reaction-diffusion processes at the nano- and microscales were investigated providing new means of understanding in different areas [20]. Tuma *et al.* [21] exploited the physics of reversible phase transition from amorphous to crystal state where that was under the reset of neuron reconfiguration of atomic structure. The optical properties of vanadium dioxide changed intensely under the change in state [22]. To configure colloidal assembly, the use of multiple laser beams may manipulate and assemble colloidal atoms in parallel form [23]. A detailed analysis was presented for complex nano-structures and colloidal nanoparticles under the description of different named forces [24]. Different interactions were considered in the formation of a variety of nanoparticles [25, 26].

An understanding in the force behavior while amalgamation of nanoparticles and particles will help to understand the energy behavior at micro, nano, atom and electron levels. Some recent studies considered the force to discuss their results; an adhesion performance of graphene/shape memory polymer micropillars was examined through adhesion force and stress distribution at the detaching rough interface [27], a basic mechanism discussed to understand interaction between inorganic and organic nanomaterial [28], and toxicity in different gold clusters under various concentrations was investigated by Sokołowska *et al.* [29].

Various chemical compounds and precursors are used to develop a variety of nanoparticles and particles. In different methods, the set conditions also introduce forcing exertions through medium dynamics in addition to exertions of forces of own drawn poles of nanoparticles and particles (when just at rest positions). They should amalgamate in different zones of solution to scheme stalls (or agglomerates). Their modes of amalgamation must identify the new parameters which have not yet been investigated or have been investigated in less detail. Dynamics should describe their behavior at all scales. Dynamics should identify locally arisen forces in relation to

fundamental forces. The amalgamation of nanoparticles and particles in suitable zones of solution is discussed, where they exhibit agglomerations in captured microscopic images. Here, forcing or forced exertions to nanoparticles and particles while amalgamation are discussed. So, their energy behaviors also. For this, bright field transmission microscope (BF-TM) images of suitable nanoparticles and particles were considered, where their development process were executed in pulse-based electron-photon/solution interface process as discussed elsewhere [10-14].

2. Results and Discussion

A tiny particle of geometrical or non-geometrical shape is in the side length of a few atoms. A molecule is smaller in size or of the same size as a tiny particle. A nanoparticle has length of each side in a few tens of nanometers. So, it is bigger in size than a tiny particle. This way, a particle has its each side length in several tens of nanometers. They are all, in different size ranges, related to colloidal entities.

On development, nanoparticles and particles fill the spaces in the solution one by one. Nanoparticles and particles are occupying different zones inside the solution depending on their threshold and population of development. Prior to amalgamate by forcing exertions and when they are still (stationary) even for a moment, they can undergo for amalgamation. The noticeable space between them depends on several factors such as composition, dimension of beaker, positions of source dynamics, input power, nature of ingredients and surrounding environment, processing time, distribution density and overall features of nanoparticles and particles, etc. Both density and distribution of nanoparticles and particles influence the rate of amalgamation. Rate of amalgamating nanoparticles and particles can be controlled by choosing their selective size and shape. Particles can collide and attach under Brownian motion, laminar or turbulent flow or relative particle setting mechanism to show their agglomeration [30].

The matching lateral widths of nanoparticles and particles can facilitate in filling vacant spaces under controlled orientation of amalgamation, where they can assume a new shape of their distribution. A nanoparticle or particle of geometrical shape is influenced by a force having a directional behavior. When a similar shaped nanoparticle or particle conceived the focusing of length to arrive within the common

vicinity, it amalgamated under the even exertion of force at electron level. Focusing of size distributions in colloidal nanocrystals was first pointed out by Peng *et al.* [31]. Size focusing methodology is due to the different levels of stability among different-sized nanoparticles [32]. Hannah *et al.* [33] demonstrated size refocusing to order phase in gold-copper nanoparticles.

Process parameters along with set-up of developing nanoparticles and particles shown in Figures 1, 2 and 3 are given in the references 10, 14 and 12 respectively. In Figure 1 (a) and (b), modes of exerting forces to nanoparticles and particles for amalgamations can be traced from the images of microscopic analyses. Nanoparticles and particles having geometrical shapes amalgamate within the common vicinities in solution under their controlled behavior of forcing exertions. When the distance between nanoparticles or between particles (or between both) exceeds the required lengths, they do not amalgamate. If amalgamate, they spend more time. In Figure 1 (a), agglomerations of nanoparticles in three different regions of a same zone is shown. In region (1) of Figure 1 (a), two triangle-shaped particles do not adhere side to side. In region (3) of Figure 1 (a), triangle and hexagon-shaped particles adjust side to side by filling the space. The nanoparticles or particles do not conceive the focusing of lengths to amalgamate indicating that their directing sides deal with uneven exertions of forces. Hence, they do not adjust side to side.

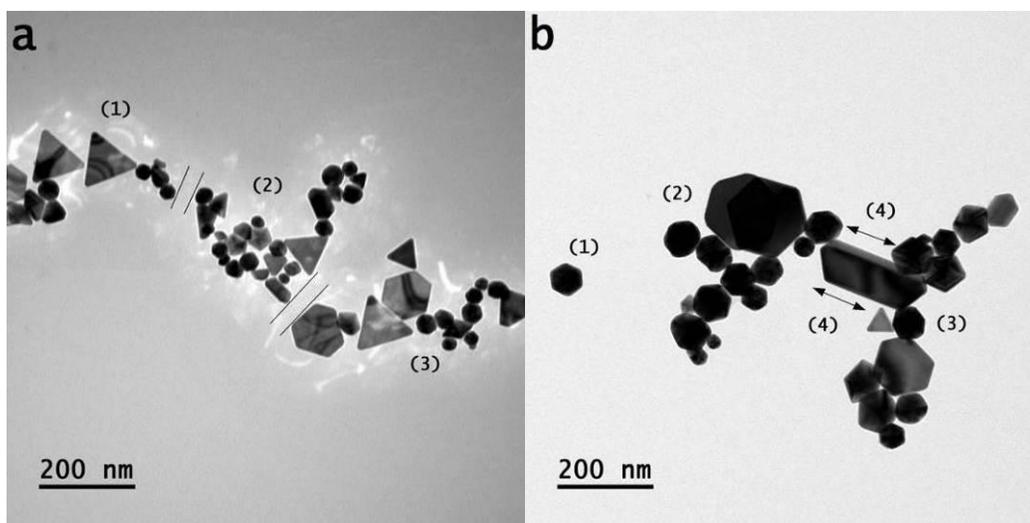


Figure 1: BF-TM images of nanoparticles and particles show modes of amalgamation in both geometrical and distorted shapes developed at (a) precursor concentration 0.10 mM, Ar flow rate 50 sccm and (b) precursor concentration 0.30 mM, Ar flow rate 100 sccm (process duration 10 minutes)

A large-sized particle labelled by (4) blocked amalgamation of nanoparticles and particles occupied regions (2) and (3) as shown in Figure 1 (b). In Figure 1 (b), a nanoparticle shown in region (1) does not conceive the focusing of length to amalgamate, so it stays alone in the solution. The exertions of force to amalgamate do not synchronize. It maintains isolation till medium dynamics are not favoring to attain length of its focus. As in Figures 1 (a) and 1 (b), nanoparticles and particles of different lateral widths overlapped as well, and they developed for different durations.

In Figure 2 (a), a hexagonal-shaped particle focuses on distorted particle with a gap of reasonable distance. They can attain favorable orientations of sides to conceive the focusing of lengths of amalgamation at common vicinity, which is through forcing exertion of the medium dynamics. When both the particles are in distorted shapes, they amalgamate under zigzag interactions as shown in Figure 2 (b). Conceiving the focusing of lengths for their amalgamation depends on the variation of forcing exertions. Their interactions with solution occur by forming the different trajectories. On amalgamation under zigzag interactions, they can also deform, where they can show scheme of their distribution in different way as shown in Figure 2 (c). To show different shape of agglomerations, nanoparticles and particles in microscopic images should either keep the same shape and size, adhere tightly, adhere loosely or overlap.

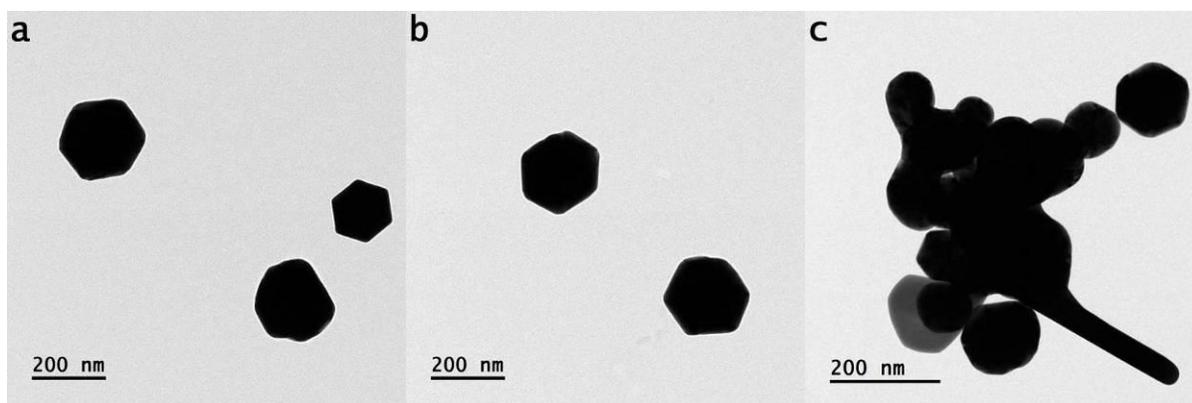


Figure 2: BF-TM images of different particles show modes of amalgamation in both geometrical and distorted shapes developed at (a) & (b) process duration 10 minutes, precursor concentration 0.60 mM and (c) process duration 15 minutes, precursor concentration 0.60 mM (Ar flow rate 100 sccm)

In Figure 3 (a-d), different microscopic images show distribution of nanoparticles and particles in different manners. Amalgamated nanoparticles and particles under

forced exertions to scheme their different agglomerations are shown in Figure 3 (a-d). Their different predicted zones inside the solution are shown in Figure 4.

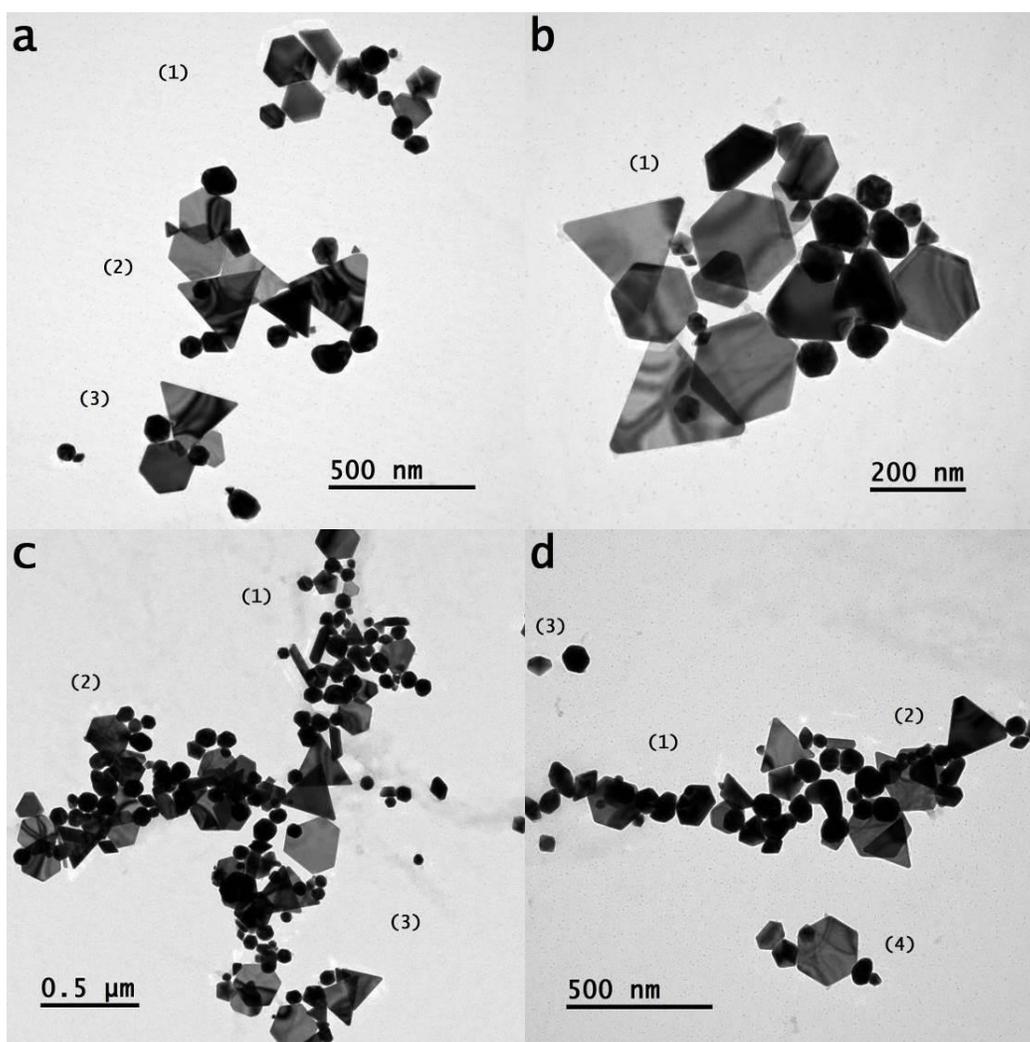


Figure 3: (a-d) BF-TM images of different nanoparticles and particles show modes of amalgamation in both geometrical and distorted shapes developed at precursor concentration 0.30 mM, Ar flow rate 100 sccm and process duration 2 minutes

There are total four quadrants (Q1, Q2, Q3 & Q4) and their schemes are displayed in Figure 4. The centre of four quadrants is related to a point where different nanoparticles and particles developed. Each quadrant can display more than one region to amalgamate nanoparticles and particles. They conceive the respective focusing of lengths to amalgamate at common vicinity. The focus can be worked out by finding the force exerted along the sides of nanoparticles or particles directed to amalgamate. Exertions of forces first orientate by tuning the sides directing to amalgamate their nanoparticles and particles. Nanoparticles and particles

shown in Figure 3 (a) depict the centers of joining in three different regions of solution within the same zone (Q1) as labelled in Figure 4. Nanoparticles and particles shown in Figure 3 (b) depict vicinity of amalgamation in one zone only (Q2), which is shown in Figure 4. Nanoparticles and particles shown in Figure 3 (c) depict vicinities of amalgamations in different zones i.e., Q2, Q3 & Q4 in Figure 4. Nanoparticles and particles of Figure 3 (d) predict common vicinity of amalgamation in single zone, Q4, along x-axis in Figure 4.

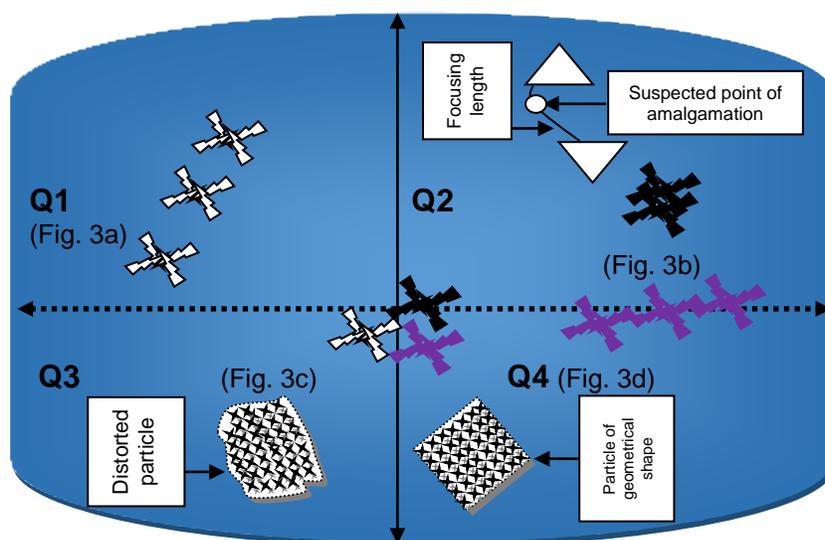


Figure 4: In Q1, Q2, Q3 and Q4, tracking forced exertions for nanoparticles and particles shown in Figure 3 (a-d); suspected point of amalgamation of two identical shaped particles is shown in the vicinity of Q2, a distorted particle having non-uniform lateral and adjacent orientations of electrons is shown in the vicinity of Q3 and a particle of geometrical shape dealing with uniform lateral and adjacent orientations of electrons is shown in the vicinity of Q4; sketch is drawn in estimation

Different interactions prevail in the course of amalgamations of colloidal entities. On amalgamation in regions of suitable zones, colloidal entities design the overall shape of their distributions. The overall displayed shape of amalgamated nanoparticles or particles (or both) under the application of exertions of forces represents their agglomeration. Nanoparticles and particles amalgamate inside the solution by locating their common vicinity. Initially, a nanoparticle or particle remains static within the solution. In static interaction of a nanoparticle or particle with solution, force remains in mute mode while energy behavior remains in functioning mode. In limiting interaction of a nanoparticle or particle with solution, a force remains in alert (in ready to work, apply, influence or exert) mode while energy also remains

in alert (but in ready to quiet, not work, not apply, not influence or not exert) mode. In kinetic interaction of a nanoparticle or particle with solution, force is remained in functioning (working, applying, influencing or exerting) mode while energy is remained in mute (quiet) mode.

On amalgamation of colloidal entities in suitable vicinity of solution, their forced exertions can be influenced by reflexes of surrounding environment, where their energy functions either to keep them still or to keep them in collective motion.

A kinetic interaction of a nanoparticle or particle having geometrical shape with solution is a controlled interaction. A focusing of length of nanoparticle or particle (in geometrical shape) with respect to a focusing of length of another identical featured nanoparticle or particle does not infer their amalgamation at midpoint (half-length) of distance noticeable between them. But they locate suspected point of amalgamation, which is at a certain distance of their conceived focusing of lengths. Because they will coordinate for amalgamation (at suspected point) with reference to (level of) exerting force along directing sides. So, a suspected point of amalgamation of two nanoparticles or particles is located through the resultant difference of forces of poles of occupied quadrant (of medium) and their own drawn poles when just at rest positions as shown in estimation in Q2 of Figure 4.

Each particle of geometrical shape conceives own length of focusing but with reference to the attending one(s) at common vicinity. This is due to the coordination of other particle(s) of geometrical shape(s). So, nanoparticles and particles of geometrical shapes amalgamate at common vicinity under the resultant difference of forces of own sketched poles from their respective drawn origins (in addition to resultant difference of forces of poles of occupied quadrant). In the final flight of amalgamation of nanoparticles and particles of geometrical shapes, when predicting the difference of forces of drawn poles from their own origins, they simultaneously consider the difference of forces influencing from the medium poles. So, in their amalgamation, they consider the resultant difference of forces belonging to at least two origins. Therefore, nanoparticles and particles draw their local poles in occupied positions. This is through the coordination of poles of occupied quadrant (or medium poles). Their amalgamation is at least under the two origins: internal origin depicted by own drawn poles (when just at rest positions) and external origin depicted by the

occupied regions of quadrant (or medium poles). So, the focusing lengths of amalgamating nanoparticles and particles are directly proportional to the resultant difference of exerting forces obtained along their directing sides. Introducing a suitable constant equalizes the proportionality between two variables. A force of the quadrant as per traced poles is already there to exert. A nanoparticle (or particle) occupies a certain region of the quadrant. It also traces own poles to deal with the forcing exertions. So, in case of considering plain region of nanoparticles or particles having identical geometrical shapes, they amalgamate side to side in the solution by coordinating with the forces of two origins mainly. There can be third origin (frame of reference) or even more origins (frames of references) when nanoparticles or particles do not possess precise geometrical shapes.

To calculate resultant difference of an exerting force to nanoparticle or particle of geometrical shape from two origins, a transformation law under the rotation of basis vectors can be helpful. There are more parameters involved while studying the amalgamations of nanoparticles and particles of different features. There can be other factors involved in the amalgamations of different featured nanoparticles and particles. In order to establish the concrete equations on amalgamations of different featured nanoparticles and particles inside the solution, much work is required.

Different lateral widths of nanoparticles or particles with the same shape alter the modes of their amalgamations. Tracking exertion of force changes largely under varying features of nanoparticles and particles. In case of distorted nanoparticles or particles, a kinetic interaction with solution is a largely uncontrolled interaction. They may deform now for amalgamation. When nanoparticles or particles possess distorted shapes, their static interaction, limiting interaction and kinetic interaction with the solution occur in more chaotic ways.

Normally, different frictional behaviors are being considered in case of solid surfaces, where two bodies are in contact. However, in a colloidal solution, a partial behavior of the force remains, which leads into introduce a partial behavior of friction in the form of interaction. So, nanoparticles and particles deal their partial interactions with the solution. Entered forces deal with even exertion (influence) throughout the solution to keep the liquidness.

Both adjacent and lateral orientations of electrons are in non-uniform distribution in disordered atoms. Non-uniform orientations of electrons for disorderly configured atoms do not let the nanoparticles and particles draw straight trajectory of appreciable length when conceived their lengths of focusing. A difference between the adjacent orientation and lateral orientation was disclosed by Ali and Lin [14]. It was found in the selective area patterns that the electrons belonging to central rings along with outer rings of elongated atoms in hexagon and triangle-shaped particles remained in lateral orientations, but electrons belonging to only central rings of atoms in rod and bar-shaped particles remained in lateral orientations [7]. Hexagon and triangle-shaped particles are related to multi-dimensional (MD) particles, whereas rod and bar-shaped particles are related to one-dimensional (1D) particles [10].

Herein, the nanoparticles and particles have distorted shapes. Their atoms attain the mixed order orientations of electrons. Their electrons neither orientate laterally nor adjacently. So, conceived focusing lengths of such nanoparticles and particles result in the non-uniform behaviors of amalgamations (Q3 in Figure 4). Here, electrons of surface atoms in amalgamating nanoparticles and particles are non-orientational based. For nanoparticles and particles having geometrical shapes, atoms keep the orientations of electrons laterally and adjacently for each face. So, they amalgamate under controlled angle interactions (Q4 in Figure 4). Electrons of surface atoms keep positioned orientationally in their amalgamating particles.

In each side of nanoparticle or particle having geometrical shape, electrons (of elongated atoms of arrays which formed structures of smooth elements) orientated orientationally. In all structures of smooth elements forming each mono layer (not monolayer) of nanoparticle or particle, electrons of elongated atoms (forming each face) orientated along its side as shown in Q4 of Figure 4. The configurations of electrons of elongated atoms in each face of 1D or MD nanoparticle or particle remain uniformly orientated. Hence, the gained (or incurred) orientational positions of electrons on each face of such nanoparticles or particles deal with a structure of consistent inter-state gap. According to the suitable design of a material, a structure of consistent inter-state electron gap can be made to work in 1D, 2D or 3D. Such kinds of materials (nanoparticles and particles) deal with an accelerated propagation of photons. As inter-state electron gaps of elongated atoms in nanoparticles or

particles of 1D or MD shapes allow photons to carry forcing energy, so their path (inter-state electron gap) can be referred to photonic band gap. To a large extent, this is not the case with distorted nanoparticle or particle as their electrons non-uniformly orientated to a large extent. So, they locally dissipate heat energy in water to work as catalytic agents. Further detail about inter-state electron gap replaced in place of band gap in materials of conductor, semi-conductor or insulator behavior is given in a separate study [5]. Originating the potential applications of distorted nanoparticles or particles in catalysis and potential applications of nanoparticles or particles of geometrical shapes in photonics is also discussed elsewhere [14].

Both solution composition and medium source influence the forcing or forced exertions exerting to nanoparticles and particles. Thus, trajectories of suspected points of amalgamations on conceived lengths of focusing in different featured nanoparticles and particles can be plotted for several ways. These require indepth studies to explore the underlying sciences. Here, different features of nanoparticles and particles need to be considered. These studies may explore interesting new insights for the scientific community. Modes of forcing exertions to nanoparticles and particles of different features are needed to be explored. A behavior of force to distorted particle and particle of geometrical shape can be selected in different ways. These open areas for researching and applying new knowledge at multiple scales.

In mathematics, new knowledge in the fields of vector analysis, vector space, topology, mechanics, calculus and analytical geometry, etc. can be established. As the shape of nanoparticles and particles becomes more and more distorted, the influence of forces in different formats also becomes more and more chaotic. This is because neither the precise length nor the precise diameter of these particles can be measured. To measure their approximate size, it is required to locate their centre of mass first. This way, the studies of colloids provide vast room for conducting new research.

In amalgamation of nanoparticles and particles, relation of exerting forces to focusing lengths and energy behavior at different levels can open countless avenues for scientific research. Such fields of studies can also engage students, researchers and scientists to conduct different statistical analyses. Fundamental questions on the

stability of colloidal nanoparticles and roles of different surfactants and ligands for them are yet to be explored [34].

3. Conclusion

Nanoparticles and particles which do not possess geometrical shapes amalgamate in solution in zigzag manner. Here, forcing exertions to electrons of their deformed atoms remain uneven along the sides. Their focusing lengths plot complex trajectories having no significant lengths; they approach, they adhere, they overlap and they amalgamate under variant static, limiting and kinetic interactions. They can deform/distort while conceiving focusing lengths under changing kinetic modes.

Nanoparticles and particles that possess geometrical shapes amalgamate under controlled exertions of force as electrons of elongated atoms get uniformly orientated along the sides. Nanoparticles and particles of geometrical shapes amalgamate under the difference of action of forces originating from mainly two frames of references (origins). On amalgamation, two such nanoparticles or particles can join side to side at midpoint of noticeable distance (length) between them. Here in ideal condition, exerting forces along directing sides of amalgamation should be in the quantized (balanced) manner because they are influenced for that from the points of rest positions. To amalgamate a nanoparticle or particle of geometrical shape, a conceived focusing length becomes functioning from the side having increased even exertion of force. To amalgamate, focusing lengths of such nanoparticles or particles plot trajectories in directional manners having significant lengths. They undertake standard interactions to amalgamate inside the solution, where forcing or forced exertions to electrons of elongated atoms are worked in a diligent manner by successively remaining mute (in static behavior), alert (in limiting behavior) and functioning (in kinetic behavior). Hence, a forcing or forced exertion to nanoparticle or particle originates energy behavior accordingly.

To amalgamate nanoparticles (or particles) at common vicinity, in addition to resultant difference of exerting forces of poles of occupied quadrant of medium, they also deal with the resultant difference of forces of their own poles when just at rest positions. So, a conceived focusing length of a nanoparticle (or particle) functions under the resultant difference of forces of medium poles together with its own drawn

poles. A force resulted along the directing side of a particle (just at rest position) is due to the resultant difference of forces of medium poles and own drawn poles, which will lead to its amalgamation at located suspected point by conceived length of focusing. This is achieved by the coordination of neighboring particle.

Nanoparticles and particles of perfect geometrical shapes having same lateral lengths amalgamate side to side, where they deal nearly quantized exertions of force, so they also deal with energy behavior in quantized manner. They amalgamate for established orientations located through their conceived focusing of lengths, so they show symmetry in amalgamation. This is also the case in microscopic images of colloidal entities as they foresee forcing exertions for amalgamations.

In nanoparticles and particles of geometrical shapes, electrons of atoms deal with uniform orientation along each side of the shape. Electrons experience the even forcing exertions along the poles, where they remain clamped by their energy knots. In elongated atoms, energy knots forming filled and unfilled states of electrons do not experience the forcing exertions. However, energy knots are influenced uniformly by the varied force and energy of their electrons. Distorted nanoparticles and particles deform in their shapes, where they do not form sides of established lengths, so they do not also have the orientated electrons of same orientation along the sides.

Nanoparticles and particles of selective features can be amalgamated under controlled applications of forced exertions. They can be used effectively as medication for human life. Like plants, they serve as medication for environment. The studies of forcing or forced exertions to nanoparticles and particles inside the solution help to develop sustainable science and technology covering applications of broad range in catalysis, electro-optics, biomedical, energy and diversified eco-friendly environments. Hence, they open several new routes for research and exploration.

4. Experimental details

Different BF-TM images discussed in Figures 1 to 3 are synthesized by setting the different process parameters, where the main parameters are given in the captions of the figures. Layouts of the setup along with different conditions are given in earlier references [10-14]. The employed method to synthesize nanoparticles and particles discussed in this work, which is called pulse-based electron-photon/solution interface

process in the studies references 10 to 14, can be referred to as photochemical method, or conventionally an electrochemical method in chemical sciences.

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Nomenclatures/definitions:

Dynamics – *Changing aspects of different entities (atoms, tiny particles, tiny clusters, tiny grains, nano crystal, molecule like structures, nanoparticles and particles, crystallites, etc.)*

Grammatical use of dynamics – *Dynamics should be used as a ‘noun’ but mainly in ‘plural’ sense. Usually, an entity should consider more than one factor simultaneously occurring to change its aspect. So, usually dynamics are related to changing aspects of an entity. However, it can also be used in ‘singular’ sense, where the employed ‘verb’ in the sentence distinctuate its meaning*

Visualized dynamics – *Observation of changing aspects of different entities while recording their behavior in the solution live*

Medium dynamics – *Changing behavior (aspect) of the medium (solution) through the development of different entities, interactions of entities with each other, interaction of different entities with the walls of beaker or container, entering of forced energy electrons, electron streams and atoms, entering of photons of different features and absorption of heat energy in the solution, etc. A medium dynamics governs its process of synergy*

Amalgamation – *This is a process taken or followed by nanoparticles and particles to join, overlap or adhere inside the solution through competing actions of forces along their sides. However, tiny particles also amalgamate to develop a nanoparticle or particle at solution surface or inside the solution*

Agglomeration – *A zone inside the solution where nanoparticles and particles amalgamated through a suitable mechanism of forced exertion exhibiting their overall picture or stall (of joining, overlapping or adhering)*

Forcing exertion – *A force disturbs to amalgamate a nanoparticle or particle inside the solution*

Forced exertion – *A force disturbed to amalgamate a nanoparticle or particle inside the solution*

Focusing length – *A focusing length of nanoparticle or particle inside the solution is conceived by locating suspected point of its amalgamation under noticeable length (distance), where one nanoparticle (or particle) can experience (deal) force (or energy) with respect to the force (or energy) of other (nearby) nanoparticle (or particle). So, through the action of force, and in rare cases, through the action of energy, they (nanoparticles or particles or both) attempt to disturb*

by hoping their amalgamation at common vicinity inside the solution. Focusing length is not useful while considering tiny particles or atoms as they do not remain still (even for a while) alone in the solution

Suspected point – *It is a point located by two entities (nanoparticles or particles) prior to amalgamate at common vicinity inside the solution, which is through conceiving of lengths of focusing of two or more nanoparticles or particles. In the case of two identical shaped (and sized) nanoparticles or particles, their suspected point can be located at midpoint of noticeable distance (length) between them (a suspected point of amalgamation of two nanoparticles or particles is located under the resultant difference of forces of drawn poles in occupied quadrant of medium and drawn poles in their respective origins when just at rest positions in that quadrant)*

Zones of solution surface – *A solution surface in beaker has four zones because of the formation of four quadrants from the point of development of nanoparticles and particles*

Regions of solution surface – *A zone of solution surface can have one region or more than one region inside the solution to amalgamate nanoparticles or particles*

Distorted nanoparticles and particles – *Nanoparticles and particles having their irregular shapes, where no certain geometry of the shape is perceptible*

Geometric shapes – *Shapes of nanoparticles and particles having their directional behavior, which mainly develop in suitable geometry of one-dimensional or multi-dimensional shapes*

Uniform adjacent orientations of electrons – *In nanoparticles or particles of geometrical shapes, electrons of outer rings (belonging to elongated atoms) deal their uniform orientations as they are in adjacent orientations under the even exertions of force*

Uniform lateral orientations of electrons – *In nanoparticles or particles of geometrical shapes, electrons of inner or central rings (belonging to elongated atoms) deal their uniform orientations as they are in lateral orientations under the even exertions of force*

Non-uniform adjacent orientations of electrons – *In deformed (or partially elongated) atoms of distorted nanoparticles or particles of irregular shapes, electrons of outer rings were in their non-uniform orientations as they do not possess fully adjacent orientations under uneven exertions of force*

Non-uniform lateral orientations of electrons – *In deformed (or partially elongated) atoms of distorted nanoparticles or particles of irregular shapes, electrons of inner or central rings were in their non-uniform orientations as they do not possess fully lateral orientations under uneven exertions of force*

Uniformly orientated electrons – *Electrons orientated either adjacently or laterally under the even exertion of force (s) along the poles*

Non-uniformly orientated electrons – *Electrons orientated either adjacently or laterally under the uneven exertion of force (s) along the poles*

Electrons of outer ring(s) – *In the structure of atoms belonging to different elements as referred in references 1-5, in elongated atoms of nanoparticles and particles having geometrical shapes, electrons of their outer ring(s) orientate adjacently through the engagement of even exertions of forces along the relevant poles*

Electrons of central ring(s) – *In the structure of atoms belonging to different elements as referred in references 1-5, in elongated atoms of nanoparticles and particles having geometrical shapes, electrons of their central ring(s) orientate laterally through the engagement of even exertions of forces along the relevant poles*

Even exertion of force – *In the atom, an electron clamped by its energy knot deals with even exertion of force when it undertakes uniform adjacent or lateral orientation*

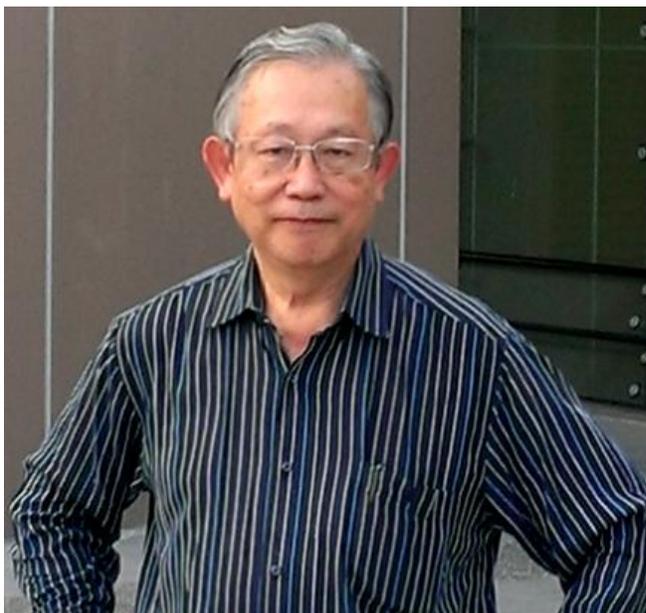
Uneven exertion of force – *In the atom, an electron clamped by its energy knot deals with uneven exertion of force when it undertakes non-uniform adjacent or lateral orientation*

Authors' biography:



Mubarak Ali graduated from University of the Punjab with BSc (Phys & Maths) in 1996 and MSc Materials Science with distinction from Bahauddin Zakariya University, Multan, Pakistan (1998); his thesis work completed at Quaid-i-Azam University Islamabad. He gained PhD in Mechanical Engineering from the 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 the 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 University Islamabad (previously known as COMSATS Institute of Information Technology), Islamabad, 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, Tohoku University, Japan to deliver scientific talk. 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 the PhD study by the Government of Pakistan, but he did not avail himself of the opportunity. He also earned Diploma (in English language) and Certificate (in Japanese language) in 2000 and 2001 respectively, in part-time from the National University of Modern Languages, Islamabad. He is the author of several articles available at following links; <https://scholar.google.com.pk/citations?hl=en&user=UYjvhDwAAAAJ>, https://www.researchgate.net/profile/Mubarak_Ali5, <https://www.mendeley.com/profiles/mubarak-ali7/>, & <https://publons.com/researcher/2885742/mubarak-ali/publications/>



His Excellency, **I-Nan Lin**, worked as a **Senior Professor** for several years at Tamkang University, Taiwan, and now **Professor Emeritus**. His Excellency received the bachelor's degree in physics from National Taiwan Normal University, Taiwan, M.S. from National Tsing-Hua University, Taiwan, and the Ph.D. degree in Materials Science from U. C. Berkeley in 1979, U.S.A. His Excellency, worked as a senior researcher in Materials Science Centre in Tsing-Hua University for several years and a faculty member as senior professor in Department of Physics, Tamkang University. Professor Lin published several hundred referred journal publications and held distinctive position in university. Professor I-Nan Lin supervised several PhD and Postdoc candidates around the world. Professor I-Nan Lin remained researching in the areas of developing high conductivity diamond films, composite materials and the deep-rooted studies of the transmission microscopy of materials.