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Effect of Elementary Carriers of Heat to Create a System of Ordered Structures

B. Utelbayev*[1], E. Suleimenov[1], A. Utelbayeva[2]
*[1]Chemical Engineering, Kazakh British Technical University, Almaty, Kazakhstan
[2]South Kazakhstan State University named after. M. Auezov, Symkent, Kazakhstan

ABSTRACT

The heat transfer between material objects realize by elementary carriers - "teplotrons" - as a result of the process and change in the structure of "chemical individuals". The distribution of the elementary discrete particles increase the entropy of the environment and lead to the emergence of ordered structures in the system (or new "chemical individuals"). In the endothermic processes "teplotrons" are absorbed by "chemical individuals", while in the exothermic reactions they would be released. Speed of movement of the “teplotron” depends on the nature of the medium. Under steady-state conditions "teplotrons" form a combination with electrons (or other elementary particles) that affects the nature and structure of "chemical individuals." This behavior of real systems when changing the distribution of elementary particles in the physical and chemical processes give to conclude about the high complexity of the structure and the energy states of atoms (i.e, the need in-depth study and improve models of atoms).

Keywords : Thermodynamics, Energy, Heat, "Chemical Individual", Photon, "Teplotron" Structure of Atom

I. INTRODUCTION

General thermodynamics studies the state and processes involving material objects, and transmission of energy forms between them [1,2]. In this regard, the thermodynamics has been used successfully in a wide field of science and technology, such as energetics, heat engineering, phase transitions, chemical engineering, etc. In this case, the processes occurring in these systems are described by the state parameters: temperature, pressure, concentration of substances, etc., which involved a large number of particles. In turn, the state and properties of interaction of the particles are characterized by statistical thermodynamics [3], and in general is phenomenological. There is limited understanding the depth of interaction of a set of particles, and does not allow to reveal the nature of influence of the microstructure on the studying phenomena in the energy transfer between material objects. Therefore, neglection of the nature of motion of elementary particles in the microstructure of "chemical individual" [4], which is reflected in the properties of the entire macroscopic system. A good example of this is the formation of diamond, graphite and carbine from their respective "chemical individuals" consisting only of carbon atoms. In-depth insight of thermodynamics into the physics and chemistry, nanotechnology, engineering, microbiology, biotechnology, biomedical engineering and materials science [5.6], requires consideration in its laws of the structure of matter at the microscopic level. In general, a simultaneous review and description the properties of micro- and macro-system refers to the most fundamental questions and still have not received a final decision in modern science.

This article is a continuation of posts published in [7-15], which examines the nature and mechanism of heat transfer and its carriers characterizing micro-macroscopic properties of the system.

II. DISCUSSION

The manifestation of physical and chemical properties of substances is the result of structural changes in the energy states of its components. There are numerous difficulties with the interpretation of microscopic phenomena, due to the lack of awareness and the availability of specific representations of their microstructures. A "chemical individual" [4], is the elementary link of macroscopic structures. However, in

the definition of the concept of "chemical individual" there are different opinions in the literature [16-18]. According to the proposals [17,18], "chemical individual" regarded as belonging to a specific chemical compound and is a phase that has a singular or Dalton points on the lines of its properties on the phase diagram. However, the concept of phase do not apply to very small amount of substance and to a system with a developed surface. In [16], it is noted that the "chemical individual" has the same physical and chemical properties, including their composition. Since "chemical individual" is the microscopic link of the macroscopic structure, where by repetition in various order, you can reproduce the substance. The same chemical composition of matter and "chemical individual" makes apparent their identity. But it should be remembered that the chemical individual refers to the microscopic level and the substance formed from the units of "chemical individual" and relates to the macroscopic level. In this regard, there are various properties of a substance depending of its dimension (nanochemistry, nanotechnology and others.). In turn, microstructure (between atoms) and submicrostructure (between the nuclei, electrons, and other elementary particles) in the "chemical individual" includes a set of constituent elements interconnected with each other, and each of them is endowed with certain properties. If a system is impacted with energy from outside , it cause changing structurally - energy compliance of "chemical individual" and redistribute electrons et al. elementary particles to form a new one depending on the nature of process. This process is accompanied by the release (or absorption) of light and heat, which also refers to chemical, biological, electrical, mechanical and other kinds of work. All of these works are characterized by transfer (redistribution) of electrons shown by M.Faradey [19]. Similarly, effect appear in nuclear reactors when **nuclear fuels** is impacted by **thermal neutrons** with energy **0.1eV**, nuclear fission occurs and release **fast neutrons** with an energy of **1.0 MeV**. The heat energy of fast neutrons are transmitted by carriers "teplotron" to substances called coolant (water), and these **fast neutrons** after giving their surplus heat energy again transform into the **thermal neutrons** with energy 0,1eV [20, p.157]. Analysis of the data suggest that there is a combination of "teplotron" with electron, neutron in the microstructure and submicrostructure (nucleus) of the "chemical individual." We have proposed the existence of "teplotron 'combined with electrons, conventionally called "novotron" [21,22]. In [23] also notes the combination of electrons with photons which Richard Feynman call "compound", "communication" or "interaction", and that has a certain analogy with the "novotron". "Chemical individuals", which consist of "nucleus" and "combination of electrons" (charged particles), as a whole remains electrically neutral. From the data of electrodynamics the interaction of charged particles between each other is called "electromagnetic". Considering this interaction and movement "of combined electrons" in the field of nuclei as a process, we assume, as a result of process which caused to release the "electromagnetic particles" and are responsible for transfer of energy [15]. These particles are formed in a "chemical individuals" are responsible for the Coulomb force of attraction (repulsion) between the nuclei and the electrons on the one hand, but on the other hand can shield them from the closer. Thus, a steady state of structural and energy compliance system is in thermodynamic equilibrium with the surrounding elementary particles of the medium. This combination of submicrostructure between nuclei and "combined electron" in the "chemical individual" may be subjected to the influence of the energy from the outside and disintegrate by releasing "electromagnetic particles" which cause physical and chemical manifestation in the form of heat, light, electricity, and others. It is directly evidence for chemical reactions where the activation energy is necessary to carry out them. At the activation of reacting substances the electrons of initial "chemical individuals" create a combination with "teplotron"- elementar carries of heat, that alter the structural and energetic state. It causes to release "electromagnetic particles" (exothermic processes), or other elementary particles in the environment increasing their entropy, which results in the formation of new ordered structures, i.e., new "chemical individuals" in the system. In the case of endothermic reactions, the excess energy is stored in the microstructure of the new "chemical individual" complicating structure, and "teplotrons" form with electrons a combination "novatron" [21,22]. Therefore, in thermodynamics taken "closed systems" are in fact "open", i.e., heat transfer occurs by discrete particles - "teplotron" [7-15,21,22]. Hence the basic principle formulated by Prigogine [23], according to which non-equilibrium processes in an open system can serve as a

source of order – self organization. In [25], for the emergence of order from chaos requires energy from outside: "First of all, it can only occur in open systems, which are continuously supplied with" high "energy (light, nuclear and others), and give to the surroundings" low-quality " energy (simply heat). If the system receives more energy than it needs to cover the heat losses, the excess energy goes to the complication of the structure". Similarly, during photosynthesis, going with the absorption of heat, light and moisture, "teplotrons" and photons are associated with electrons entering the micro- and submicrostructure of "chemical individual." Accumulated so solar energy, assimilated by plants, can be allocated in the form of heat and light back in the destruction of an ordered microstructure of the "chemical individual".

In our view, the terms used for the intended purpose must comply with defined reality, and in this regard, the term "energy" refers to a conceptual expression that characterizes the movement of particles (matter) quantitatively and qualitatively (*various combinations of elementary particles, phase transitions, motion of macroscopic objects and others*.). At the time, M.Lomonosov for the first time united in one formulation of the laws of conservation of matter and motion, which he called "universal natural law" [26]. That wording implies that the movement is a property of a material object, therefore, to describe the motion of the body or other physical structures the researcher used such as speed, strength, "energy" of the concept, and others. Since the energy characterize the effects of "power", the commission of works, the transmission of electricity, heat, etc. through the motion of material objects, then naturally the existence of relationship between the mass , speed (acceleration, etc.) and energy for massive bodies in the form $E = mgh$, $E = mv^2/2$, and for elementary particles $\varepsilon = mc^2$ and $\varepsilon = h\nu$. These equations show the functional relationship between the energy and mass characteristics of motion, i.e., equivalence of two different categories, which are not identical. However, to balance the equivalence equation $\varepsilon = mc^2$ was necessary to take to the material body have the speed of light, i.e., its particles have a light characteristic such as "solar radiant energy". In turn, there was a polar views on the spread of solar energy: some believe that the light beam represent a stream of discrete particles (Newton et al.), but others take it as a wave (Gook, Gyugens et al.) [20,27]. In fact, the wave pattern is a trajectory of motion of material particles from "elementary" to "appropriate" size of the participants of wave process. Wave properties such as interference, diffraction of light and marked spheroid wave [27, p.46], due to the characteristic movements of the constituent elements of the display. In [27, p.144] Jung says that "..everyone light waves propagate through a homogeneous medium in the form of concentric surfaces of the sound waves. They simply consist of direct and reverse motion of the particles in the direction of the radius with the accompanying these movements compressions and depressions". Analysis of the above and the dialectical condition of material objects give reason to assume a dipole structure and pulsating character "of electromagnetic particles" to which belong the "teplotrons" [15,28]. In our opinion, "concentric surface" and "movement of particles in the direction of the radius accompanying by compression and depression" in the truest sense characterize the "pulsating " of discrete particle (consideration of dipole structure and pulsating - beyond the scope of this article.). In favor of this, indirectly serve heat radiation of Max Planck's equation $\varepsilon = h\nu$, where v is the rate of change expresses the AC poles (experiments of Hertz), which is proportional to the frequency of the "pulsating" emitted particles. Therefore, a ray of sunshine is a set of "electromagnetic particles" - photons, each pulsation represent a standing wave [13].

Distribution set of standing waves in the space create a picture of a traveling wave, adopted in the scientific literature, "electromagnetic waves" and the correctness of the two groups of scientists headed by Newton and Hooke, Gyugens.

Energy of "pulsating discrete particles" in the form of light is described by Einstein's equation $\varepsilon = mc^2$. In [29] he concludes: ".. If a body gives off the energy " ε " in the form of radiation, its mass decreases on ε/s^2." This means that an elementary particle with a mass of «m», at motion characterize by energy «ε», i.e., describes the mass of matter in motion with the speed of light in vacuum. However, in reality, to calculate the speed of the elementary particles carrying the thermal energy in the air we use an equation of thermal conductivity ($\varkappa$) resulting from the molecular-kinetic theory of gases that used earlier in [9]:

$$\varkappa \sim \frac{1}{3}\rho c_v \lambda \bar{v}$$

where λ - the mean free path of molecules, $\overline{\upsilon}$ - the average speed of their movement, ρ - the density of matter, C_V - isochoric specific heat. For air thermal conductivity is 0.026Vt / (m · K); heat capacity 1000J / (kg · K); 1.14kg / m^3 density of air at 293 K and the mean free path of air molecules is $4 \cdot 10^{-7}$ m. The rate of elementary particle of heat carrier in the air is:

$\overline{\upsilon}$ = 3 · 0.026 / (1.14 · 1000 · $4 \cdot 10^{-7}$) = 170 m / s

The "teplotrons" releasing from the system into environment increase their entropy, and cause the organization of ordered structures in the system. This is clearly observed on the example of the chemical reaction of hydrogen combustion flowing in time, under standard conditions(P = 1 atm., T = 298K). Enthalpy formation of liquid water 285.83kJ/mol [9]. In considering the heating, evaporation of liquid water into steam, and heating of steam from 373 K up 3173K (highest temperature combustion of hydrogen) the change in entropy and the amount of consumable heat calculated by the well-known formulas of thermodynamics. At heating the water from 298K to 373 K entropy change is as follows:

$\Delta S1 = C_p^{liq} \ln 373 / 298 = 4.218 \cdot 18 \cdot 0.2244 = 17.039 J / K$

The amount of heat: $Q = C_p^{liq} \cdot \Delta T = 4.218 \cdot 18 \cdot 75 = 5.694 \cdot 10^3 J$

When the water evaporates:

$\Delta S_2 = \Delta H_{ph.con.} / T = 2260 \cdot 18/373 = 109.060 J/ K$

The amount of heat: $Q = 2260 \cdot 18 = 40.680 \cdot 10^3 J$

When heated, the water vapor from 373 K to 3173K

$\Delta S_3 = C_p^{gas} \ln 3173 / 373 = 2.02 \cdot 18 \cdot 2.141 = 77.838 J / K$

The amount of heat: $Q = C_p^{gas} \cdot \Delta T = 2.02 \cdot 18 \cdot 2800 = 101.808 \cdot 10^3 J$.

The amount of heat spending for the work of expansion:

$Q = R (T_2 - 373) = 8.314 \cdot 2800 = 23.279 kJ$

The entropy change at isobaric (P ≈ 1 atm) extension determined from the formula:

$\Delta S_4 = (C_p^{gas} - R) \ln 3173 / 373$ where $V_2 / V_1 = T_2 / T_1$

$\Delta S_4 = (36.360 – 8.314) \ln 3173 / 373 = 28.046 \cdot 2.141 = 60.04 J / K$

The total entropy change: 109.060 17.04 + 77.84 + 60.04 = 263.98J/K

The total of heat: $(5.694 + 40.680 + 101.808 + 23.279) \cdot 10^3 = 171.461 \cdot 10^3$ J

However, apart from $171{,}46 \cdot 10^3$ J of heat to the environment distributed $(285.83 - 171.46) \cdot 10^3 = 114.37 \cdot 10^3$ J of heat at combustion which increased the entropy of the air on ΔS_5. To calculate the entropy change we determine the temperature T_f by the formula:

$T_f = (C_1T_1 + C_2T_2) / (C_1 + C_2);$

$T_f = (36.36 \cdot 3173 \cdot 29.14 + 298) / (36.36 + 29.14) = 1893.9K$

where C_1 and C_2 is the heat capacity of steam and air; T_1 and T_2 temperature of steam and air, respectively.

$\Delta S_5 = Q / T ; \Delta S_5 = 114.4 \cdot 103 / 1893.9 = 60.38 J / K$

The total change in the entropy of the environment:

(60.38 + 263.98) = 324.36J/ K

Reducing the entropy of the system is 263.98J / K, and the increase in entropy of the environment 324.36J/K which makes the organization of the “chemical individual" water by condensing it into liquid. Furthermore, for this process [9], we calculated the change in mass of the system due to the release of "teplotron" . The calculated mass of "teplotron" is approximately $5.28 \cdot 10^{-36}$ kg, energy $4.75 \cdot 10^{-19}$J and frequency of pulsation is about $7.16 \cdot 10^{14}$Hz [9, 11-13].Change of mass and entropy at heating process in the system are proved by calculations in [30]. All these transformations with changes in temperature affect the structural-energy state and the entropy of the system respectivily which allows to make the following conclusion:

- the transfer of heat with discrete particles directly affects to the structural and energetic state of system and the identification of this mechanism will provide opportunities to control the properties of the system with the specified characteristics.

All the observed experimental data indicate that "electromagnetic particles" are formed in the "chemical individual" during the process between nuclei and "combined electron". There is an equilibrium with the environment making the matter in compliance with the temperature, color and other properties corresponding to this substance. Impacting to the system from outside which affected to the structural and energy compliance of "chemical individual" cause allocation of "electromagnetic particles" with the excess energy. The amount of these releasing particles proportionally to the impacting energy from outside as a result of the collision with the components of the environment form a "combination", obeying the laws of classical physics [14]. Thus, "teplotrons" perform expansion work and increase the energy of the system . For example, at burning one mole of natural gas it generates heat equal 890,3kJ and temperature reaches 2300K [11].The expansion work is calculated using the well-known formula*:*

$$P \cdot \Delta V = R\,(T_2 - T_1)$$

where P is the standart pressure $1{,}01 \cdot 10^5$Pa; ΔV - volume expandable air; R- universal gas constant; T_2 and T_1 - the flame temperature and the average temperature.

The work done by the expansion:

$$8.314 \cdot (2300\text{-}300) = 16.63 \cdot 10^3 J \text{ or } 16{,}6kJ.$$

Into the environment dissipated as heat: ***890.3 - 16.6 = 873,7kJ.*** Here, we neglect the absorption of the heat by reaction products CO_2 and H_2O and determine the amount of space spreading heat according to the equation:

$$1.01 \cdot 10^5 \cdot \Delta V = 8{,}314\ (2300\text{-}300);\ \Delta V = 0{,}16m3$$

Assuming the distribution of heat in the volume of a sphere, calculate the radius of this sphere volume 0,16m3:

$$(4/3)\ \pi R^3 = 0.16m^3$$

We determine the radius of the prevalent heat in the space:

$$\mathbf{R = 0{,}34m.}$$

Consequently, due to resist ambient air and making the work of expansion, "teplotrons" can't overcome long distance and are absorbed by the components of the environment to form a variety of "combination".

III. CONCLUSION

As we have shown previously [7-15,21,22,31], that heat carriers are elementary particles called "teplotron" to be related to the "electromagnetic particles". The speed of movement of "teplotron" depend on the nature of the medium. At distribution they can interact with the elements of the environment and increase their entropy. At the same time, this cause the appearance of ordered structures in the system (or new "chemical individuals"). This behavior of real systems during the physical and chemical processes and their various manifestation as result in the change of distribution of elementary particles between nuclei ,electrons and environment gives a basis conclusion about high complexity of the structure of atoms (i.e, the need to improve the model of the atom).

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