HYDROGEN –THE SUBSTANCE OF SPACE ORIGIN IS NOT GOVERNED BY THE EARTH LAWS OF MOLECULAR-KINETIC THEORY OF AN IDEAL GAS (Part II)

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3. INTERPRETATION OF EXPERIMENTAL GAS LAWS FROM THE POINT OF VIEW OF NATURAL THEORY

3.1. Let us bring the coordinates field to natural appearance (fig.4). We shall lead X-horizontal axis of zero thickness from the point, where the rays of graphics of proportional dependence of thermal expansion coefficient β_T, meet, individual for each particular gas and let us put a hairline from it at 8.33*mm* distance down alongside Z, corresponding to - 1ºC temperature on mercury thermometer. According to evaluation, the thickness of axial line X, separating -ºC from 0K, will be equal to 8,33mm × $\frac{-1^{\circ},C}{-273{,}15,^{\circ}C} \approx 0{,}3$ *mm*. As the result positive temperature will now be determined from the upper edge, corresponding to -ºC, while negative temperature (below the absolute zero!) – from the lower edge of X-axis alongside -Z.

Thus, experimental data, provided by Gai-Lussac in their graphical representation are but slightly high only for a part of thickness of the line of X-coordinate axis, where 8.33 should be multiplied by 0.00375, instead of 0.00366. Thus, Gai-Lussac's law, named as the law of the uniform expansion of gases is self-refuted by graphics lines, in the form of rays of proportional dependence $\beta = f(p)$, going from the starting point of the coordinates (-ºC),where every real gas is characterized by its individual angle of inclination, determined from the horizontal axis , in the counter-clockwise direction (along +Z).

However, hydrogen's line, unlike all other gases originates from 0,K point and is characterized by negative inclination angle (in clockwise direction) into the sphere of temperatures, below the absolute zero (-Z). Thus, experimental data refute the theoretical fundamentals of classical molecular physics i.e. the speculative model of an ideal gas.

Physical properties of gaseous hydrogen do not correspond completely to traditional notions on physical properties of the earth bodies, being in gaseous aggregate state, because: if all gases, known on the earth expand at heating***, hydrogen is compressed, when heated.***

Let us make a more precise definition of our discovery: *gaseous substance, known as hydrogen H_2 ,filling the universe, possesses the opposite physical property, as compared to gases of the earth origin, namely, the power level of macro volume of hydrogen, determined by means of temperature is characterized by absolute negative coefficient of* ***thermal compression.***

As it was said in the abovementioned work [2] "at constant pressure the volume is changed, alongside with temperature growth". In other words the motion of graphics lines will be similar, due to the validity of the laws of Boyle-Marriott and Gai-Lussac. For hydrogen it means that physical properties of the media of space origin differ in principle from the gas media on the Earth.

3.2. The arbitrary zero value of pressure at the point, where coordinate lined cross could be substituted by tn j_p^{-2} value , i.e. by pressure at which the curves (fig.1*b*) are asymptotically close to $pV = 1$ value. Now $tn\ j_p^{-2}$ - is the initial condition when a discrete transition from liquid aggregate state into gaseous phase is observed for all gases. We'll put down uniform scale distances at 0.00005 = s*n* 5 j^{-5} on the ordinates axis along +Z, beginning with the double level of zero temperature. Along the abscissa axis we'll put down sections, 0.01*at* each, hence the increment of a section could be determined by $\Delta p = j_p^{-2} + (n \times 0{,}01)$ formula, where n – is the number of section s on scale. Thus, the range of numerical indices along X-axis will be stretched from the beginning of the scale. For example, the pressure mark, corresponding to 1 *at* after the system of coordinates was transformed would correspond to increment of $\Delta p = j_p^{-2} + (10 \times 0{,}01) = 0{,}11$ *at*.

The calculation of functional; dependence of the negative compression coefficient of hydrogen

$(-\boldsymbol{\beta}_H) = f(T^{-1})$ is represented as the graphic of the curve, originating at the boiling temperature

$$T_{boil} = -252{,}6\ ^oC,\ \beta_{l\text{-}g\ (H)} = \frac{1}{252{,}6} 0{,}00396 \mp 0{,}396\ j_p^{-2},$$

i.e. at the point on the ordinates axis +Z. The following level liquid hydrogen energy corresponds to the temperature of melting (solidifying):

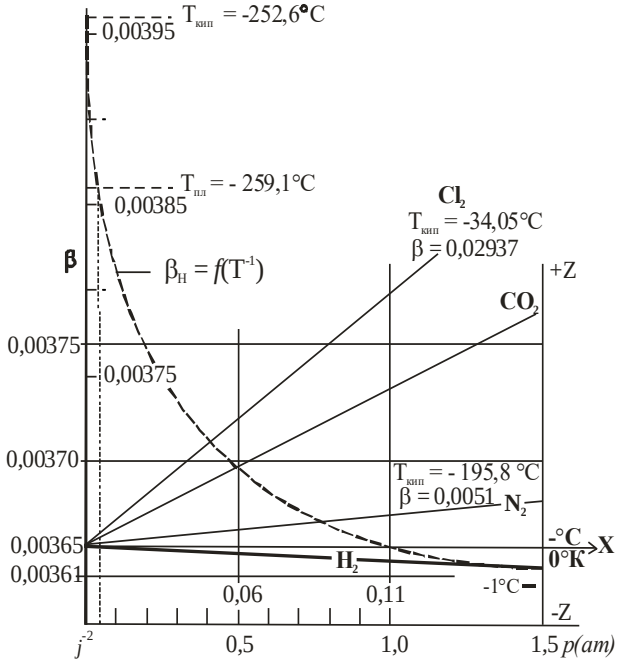
$$T_{melt} = -259{,}1^oC,\ \beta_{s\text{-}l\ (H)} = \frac{1}{259{,}1} = 0{,}00386 \mp 0{,}386\ j_p^{-2}.$$

The temperature interval $T_{melt} - T_{boill} = 6{,}5^oC$, will be evaluated by the difference of the corresponding coefficients: as the order of decimal fractures $sn\ j_p^{-2}$, here, is caused by imperfection of the applied system of units of measuring of specific pressure. Let us compare now the numerical values $\beta_{s\text{-}l(H)} = 0{,}386$ и $\beta_{l\text{-}g\ (H)} = 0{,}396$, evaluating difference:

$$\beta_{s\text{-}l(H)} - \beta_{l\text{-}g\ (H)} = -\ 0{,}01 \cdot sn\ j_p^{-2} \mp -sn\ j^{-2} \cdot sn\ j_p^{-2} \qquad (6)$$

It follows from formula (4) that the difference is equal to the product of limitless negative $-\ sn\ j^{-2}$ and dimensional $sn\ j_p^{-2}$.

The projection of the point of T_{melt} level upon the abscissa axis (fig. 4) points out at pressure



Figue 4. Discovery of the negative thermal coefficient of hydrogen compression.

increment up to 0,01 + 0,004 = 0,0104 *at*. It appears that the property of water to expand at freezing (which is considered normal), unlike the normal property of liquid metals to contract at solidifying, is caused only by the unique physical property of hydrogen.

The difference between hydrogen's boiling temperature T_{boiln} and the temperature of absolute zero $T_{0,K}$ в ºC is equal to $T_{boil\ H} - T_{0,K} = -273{,}15 - 252{,}6 = -20{,}55^oC$, while the difference between the absolute coefficient β_T and negative coefficient of gaseous hydrogen compression $(-\boldsymbol{\beta}_H)$ is equal to:

$$\beta_T - (-\boldsymbol{\beta}_H) = 0{,}366 - (-0{,}396) = +0{,}03\ j_p^{-2}\ 3j^{-2}\ sn\ j_p^{-2}. \qquad (7)$$

It appears that the absolutely precise result is three times bigger than the dimensional leap of potential energy, consumed for aggregate transition of liquid hydrogen media into solid state.

The estimated curve $(-\boldsymbol{\beta}_H)$ crosses the graphics of directly proportional dependences of each gas and then when it goes to the area of temperatures, below the absolute zero at $\rho > 0{,}11$ *at* it touches the straight line of $\mathbf{H_2}$. The projection of points upon the abscissa axis seems to be giving the pictorial view of the value of pressure for each gas at thermal-dynamic equilibrium We'll explain why this is not true, by taking nitrogen as an example (The smallest angle of inclination from horizontal axis as compared to other gases).

At $T_{boil\ N} = -195{,}8\ ^oC$ the original thermal coefficient of expansion $\beta_N = 0{,}00510 \mp 0{,}51\ j_p^{-2}$. This value of β_N (for a chosen dimension of the ordinates axis) exceeds very much the upper level of $-\boldsymbol{\beta}_H = 0{,}396\ j_p^{-2}$. It is not necessary to extrapolate the line into the area of pressure $p < j_p^{-2}$ just because this value of p was taken as the beginning of nitrogen existence in gaseous aggregate state.

Thus, principally new, vivid notions of the natural properties of gases to expand when heat energy is applied into the closed volume proves how mistaken molecular-kinetic theory can be in the domain of notions, regarding the ideal gas, that is supposed to exist at $p < j_p^{-2}$ pressure, as well as regarding the causal, substantial notion of temperature as physical value, showing the integral level of the internal energy of gas media in closed volume.

CONCLUSIONS:

1. Gases, possessing different, strictly individual fine power atomic structure, do not turn, under any conditions into featureless, idealized media, which is said to be have been described by the classical molecular-kinetic theory.

2. Mistaken notion of the existing coefficient of thermal expansion, uniform for all gases β = 0,00366 ≒ 0,366 j_p^{-2} is refuted *by the original values of coefficients,* strictly individual for all gases, known on the Earth, which were evaluated at the temperature of evaporating and the initial condition s*n* j_p^{-2}.

3. Hydrogen does not obey in principle the earth law of gas expansion at heating, for this media of space origin expands at temperature decrease T_{boil} = -252,6ºC to the absolute zero and bigger, this is proved by the character of the evaluated curve $(-\beta_H) = f(T^{-1})$ of inverse proportionality and pressure increment, estimated experimentally.

4. The assertion of the molecular-kinetic theory of an ideal gas, regarding " the physical sense of temperature, as the value, proportional to average kinetic energy of forward motion of molecules" should be considered as baseless. It is necessary, then, to reconsider the basic notions, regarding heat- thermodynamics and also reveal physical sense of *m* symbol, denoting mass of an arbitrary body.

4. DISCUSSION OF THE NEW NOTION ON EXAMPLE OF THE WELL KNOWN FACTS

4. 1. Let us consider s*n* $j^2_{[^\circ C]}$ = 100º C, i.e. temperature interval, preceding water evaporation (chemical compound, known as H_20).

The evaluation, in accordance with the formulae, proposed for an ideal gas shows that hydrogen pressure at this temperature is increased in:

$$P_{(H)} = p_0 \{1 - [-\beta_{l\,(H)} T_{boil}]\} = p_0 \{1 - [-\frac{1}{252,6} \times 373,15\ K]\} = p_o\,(1+1,477) = 2,477 \text{ times} \quad (8)$$

Unit's volume is diminished in the same proportion Still, oxygen unit's volume is increased, heated by 2 orders in (s*n* $j^2_{[^\circ C]}$):

$$V\,(O) = V_1\,(1 + \beta, \frac{0,C}{0,K}\ T_{boil}) = V_0\,(1+ \frac{1}{273,15} \times 373,15\ K) = (1+1,373) = 2,373 \text{ times} \quad (9)$$

If we compare the results we'll see that the numerical difference between them is 0,1, i.e. (s*n*1j^{-1}). However, hydrogen decreased its volume in accordance with the value of order, while the volume of oxygen was increased by one order. It appears that that the critical value of the introduced heat energy, at which phase transformation happens determines s*n* $j^2_{[^\circ C]}$ with temperature dimensionality ºC. Still the rules of abstract mathematics, devoid of physical sense assert that $(0,1)^2 = 0,01 =$ s*n* j^{-2}, but in no way s*n* $j^2_{[^\circ C]}$.

So, in this way the processes, different in dimension and opposing in nature of hydrogen H_2 compression and expansion of oxygen O_2 i.e gases, located in different part of the Periodic table, when heat energy is introduced until the critical value of s*n* $j^2_{[^\circ C]}$, are accompanied with the motion of water mass in the form of convective flows, formation of gas bubbles, emission of wave energy of sound frequency, the bubbles growth and their emersion when they join, forming bubbles of bigger sizes, steam emission from the surface and finally with swirling of the entire water masses inside the vessel, limiting the volume of the liquid 2/3^{-rd} of the globe's spherical surface is covered with water, the motion of which cannot be without a cause. So, what are the factors that operate enormous work of cold and warm ocean tides and rivers and what does the average annual temperature on the Earth and on separate spots, in different seasons and different time of day depend upon?

Behaviour of hydrogen in the living matter (proteins, nucleic acids, fat, carbohydrates etc.) practically cannot be explained from the point of view of both electron-nuclear atomic model and the classical molecular-kinetic theory of macro-volume of an ideal gas.

4.2. Similar evaluation of the degree of hydrogen compression at the temperature of iron melting shows the numerical value equal approximately to 8 times. Hence, the increase of hydrogen volume at solidifying is characterized with the same number. Hypotheses, explaining formation and development of cold hydrogen cracks in high-tensile steels, known at the time being must be incorrect, because they are devoid of this unique property of hydrogen. Creation of new high-tensile steel grades, alloyed with hydrogen, new technologies of worn out parts renewal [11] could be one of promising branches of technical science. It appears that the unknown physical properties of hydrogen i.e. its unusual behaviour at heating and cooling is the main factor, hampering development of new construction materials with increased strength as well as design of noospheric

4.3. With regard to discovery of *negative thermal* ***coefficient of hydrogen compression*** a question is bound to arise: if there is no limit for

hydrogen at negative temperatures, then what is the ultimate degree of compression that gaseous, singular hydrogen volume can reach and what temperature can be considered as critical? It is known that "effective temperature on the surface of the Sun, determined according to the law of emission of Stephan-Bolzman is equal to T_C = 5770 K[1]. Let us evaluate pressure (expressed in the terrestrial units) at constant volume, which is reached on the Sun's surface at ***thermal compression*** of hydrogen:

$$p_C = p_0 [1 - (- \beta_{ж\ (H)} T_C] = p_o [1 + (\frac{1}{252,6} \times 577^0\ K)] = 23,8492 atm. \quad (10)$$

Physical science considers the Sun's mass to be a red-hot ball of plasma. However, such temperature can be observed in the column of electric arc at welding of metals [12], hence, the evaluated degree of compression of hydrogen at such temperatures is but a common phenomenon.

For investigation of behaviour of gases the volume is regulated by vessel's walls. Is it possible to substantiate the volume of an atom of hydrogen (a molecule) as being a unit volume in order to calculate its real volume on the surface of the Sun, using electron-nuclear model?

The theory of terrestrial matter is built upon hypothetic three-dimensional model of atom, *the energy space* of which being electrically neutral. So, it appears that the so-called fourth state of matter is formed on condition, when potential, electrically neutral mass of each atom is 100% divided into different charges?

Let us suppose now that Boor's radius, evaluated by means of the formula: $\alpha_0 = \alpha / (4\pi R_\infty)$ = 0,529177249(24), Å determines the volume of the ball $V_н = 4/3\pi\ \alpha_0^3$. In order to make our calculations simpler let us double α_0, or to make it even more simple let us suppose to be equal to $r_н$ = 1Å. The result of our calculations of the ball's volume is equal to 0,424430 Å^3. Divided by 24 times it will be 0,0176Å^3. Knowing the volume it is easy to evaluate the diameter of heated to the limit, hence ultimately compressed atom of hydrogen, expressed in terrestrial units of length.

Then it follows:

- the origin of thermal-nuclear reactions on the Sun is attributed to the unique physical properties of hydrogen, opposed to the uniform property of gases of terrestrial origin to expand at heating.

Let us round the boiling temperature, expressed in ºC, in order to show *natural quantum nature* of the smallest temperature, measured on the Earth, at which gaseous hydrogen is formed.

$$T_{boil\ H} = -250ºC = -\frac{1}{4}\ j^3_{[^\circ C]} \ \digamma\ -(½)^2\ j^3_{[^\circ C]}. \quad (11)$$

Here the numerical value is- negative quantum number, multiplied by itself (square number), the *order of which is caused by natural units of measurement in terrestrial conditions, substantiated by natural physical properties of a liquid metal – **Hg**-mercury* (Z 80), i.e. *m.e.dimensional sn* $j^3_{[^\circ C]}$, equal to one thousand degrees Centigrade.

Hydrogen negative coefficient of thermal expansion – $\boldsymbol{\beta}_H$ acquires here its second value, equal to

$$-\boldsymbol{\beta}_H = -\left(\frac{1}{2}\right)^{-2} = \left(\frac{2}{1}\right)^2 \digamma\ (2)^2\ j_p^{-2}, \quad (12)$$

where the numerical value is determined by the inverse in space (mirror-reflection, asymmetrical) quantum number [13] $\left(\frac{1}{2}\right)^{-1}$ = 2/1, in the second degree, and its dimensional value – by dimensional *sn* j_p^{-2}.

Then, having considered the error in measuring the temperature of the Sun's surface, using the radiation method as equal to 3,8% = $\frac{6000-5770}{6000}$, we can maintain that the temperature upon the Sun's surface is equal precisely to:

$$T_C = 6000ºC\ \digamma\ (2\times3)\ j^3_{[^\circ C]},$$

the evaluated pressure being $p_C = 24 = (3\times2^3)$ *at*.

Thus, quantum structure of hydrogen atom, comprising the Sun's mass appears to be the source of light, heat (radiation), electromagnetic and other types of energy for all planets of the sun's system.

In this connection a question arises: will the Sun get cool, emitting energy? What will remain when hydrogen leaves the cooled down surface of the Star, due to its expansion? For material particles (atoms) of hydrogen must be attracted to the red-hot surface of the ball, like any other material body, gaseous hydrogen media should be compressed by the internal forces of gravitation 24 times, thus initiating thermal-nuclear reaction, resulting in radiation of weightless light energy of *anti-gravitation type.* It appears that the process of heating and compression of hydrogen is correlated and self-organized in the dimension of the Sun's planetary system, *while the origin cause of thermal-nuclear reactions of the Sun's gravitational mass is attributed to the physical property of gaseous hydrogen, the lightest substance in the Earth's*

gravity. It is obvious that the notion of an arbitrarily taken mass of a material body, if we speak about the Sun's mass is inapplicable, if it is equal to the following value in arbitrary mass measurement units, used on the earth (kg):

$$M_C = 1{,}990 \cdot 10^{30}\ кг \ \Gamma \left(\frac{1}{2}\right)^{-1} j^{30}_{[кг]}.$$

Due to the fact that it is impossible to weigh "*the Sun's gravitating*" mass on the ordinary spring balance it possible to neglect the error of about 0,5%. And then the Sun's gravitational mass is equal to a mirror-like symmetric, strange, *quantum number* (inversed in space), the order of which is determined by a dimensional number of *the main dimension nGs* $\boldsymbol{j}^{\mathbf{3}}_{[\mathbf{кг}]}$.

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