NATURE OF ENTROPY OF MIXING

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Abstract

Hypothesis is suggested according to which changes in entropy of mixing proceeding in physical and chemical processes are considered to be permanently related to interaction between matter and Physical Vacuum. Experimentally acquired results are given on Physical Vacuum - material body interaction at various energy effects that brought about reduction weights of bodies via increases in energy density of Physical Vacuum around them. The same effect was also observable with an increase in entropy of mixing which might be explained via energy transfer from body to Physical Vacuum with total energy of open system (matter plus Physical Vacuum) remaining unvaried. Therefore, in free energy equation the first term, i. e., internal energy (ΔE) determines energy processes proceeding in matter itself, and the second term ($T\Delta S$) which comprises the entropy defines the energy processes related to the interaction between this matter and Physical Vacuum.

1. Introduction

The law of energy conservation reads that in all processes proceeding in an isolated system the internal energy of a system which is a sum of kinetic energies and energies of interactions (potential energies) between particles of the particular system remains constant. The same is also proved by first onset of thermodynamics (the energy conservation principle). However, the internal energy in itself does not yet determine the thermodynamic equilibrium state of a system. The thermodynamic equilibrium state is described by the free energy value and constitutes the second onset of thermodynamics:

$$\Delta F = \Delta E - T\Delta S, \qquad (1)$$

where ΔF is free energy variation,
ΔE is variation in internal energy of system,
ΔS is variation in entropy of system,
T is absolute temperature.

The major property of a system that determines the equilibrium state is entropy. In case of solutions, homogeneous mixtures and molten alloys from initial components the entropy of mixing (ΔS^{mixed}) enters the equation of free energy [1]. Irreversible physical - chemical processes are always attended with an increase in entropy and characterize a transfer from unstable to a stable state.

Reasoning from equation (1) the system becomes increasingly stable the lower is its internal energy (e. g., heat release upon components mixing when a solution or an alloy takes the minimal energy state) and the higher is entropy of mixing. However, the mixing process may proceed spontaneously even when the energy of a system (ΔE) increases if the contribution made by the entropy term ($T\Delta S$) into the free energy equation is significant. To some extent this

contradicts the law of energy conversation although the second law of thermodynamics only determines the direction of energy processes, but not the energy balance. This discrepancy basically arises from the fact that physical sense of the entropy of mixing is not yet quite clear and its determination according to quantum mechanics as a number of the probabilities of system state does not reveal the energy nature of entropy.

In this paper we made an attempt to come closer to the understanding of the physics - energy nature of entropy via considering a variation in the value of entropy of mixing in physical-chemical processes to be a result of the interaction between a matter and Physical Vacuum (PV). Our first investigations in this direction are described in paper [2].

2. Mechanism of Physical Vacuum - Matter Interaction

A great number of theories exist that consider Physical Vacuum or ether as it was called earlier to be not an empty space but some energy medium where a matter exists and that is a medium of propagation of waves and interactions - gravitational, electromagnetic etc. When deriving his famous equation of electrodynamics Maxwell proceeded from the existence of Physical Vacuum. Paul Dyrak considered FV to be a compensated state of electron - positron pairs that induces their spontaneous origin during PV energy fluctuations.

As we understand Physical Vacuum, that fills up the space of the Universe is a matter not in a pure form but energy bunches forming the space elastic lattice (figure 1) [3, 4]. That is why, PV is a matter only in the sense of energy, it has so to say a "pseudomass". The structure of a Vacuum node is considered to be a double torus having right-screw and left-screw twists, which determines positive and negative polarities of PV. The PV polarity is essentially compensated by the unavailability of external action at a slight shift to the negative area [4, 5].

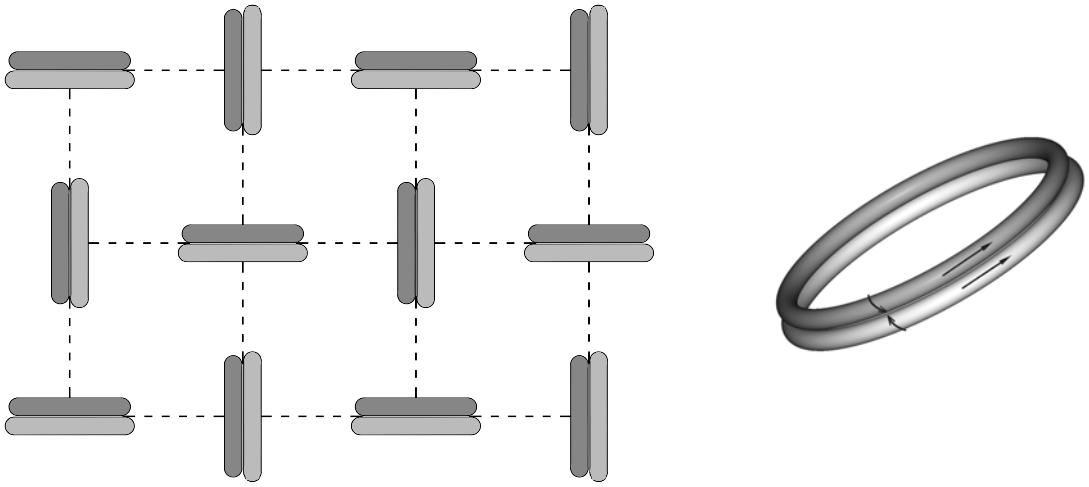


Figure 1. Schematic presentation of Physical Vacuum structure and node

The matter formed from Physical Vacuum (during the Big Bang or electron - positron pair born from γ-quantum) remains bonded to it. Hence, any energy action on a matter, viz., deformation, heating etc, via oscillations of atoms lead to the intensification of oscillations of energy nodes of Physical Vacuum lattice and, consequently, to an increase of the energy density of the latter.

Energy exchange with PV proceeds particularly intensively in water and aqueous media [6, 7]. The investigations were carried on in a specially designed stand that comprised two vortex heat generators. The appearance of the testing stand is illustrated in figure 2, the general circuit of the stand is shown in figure 3.

Figure 2. The appearance of the testing stand

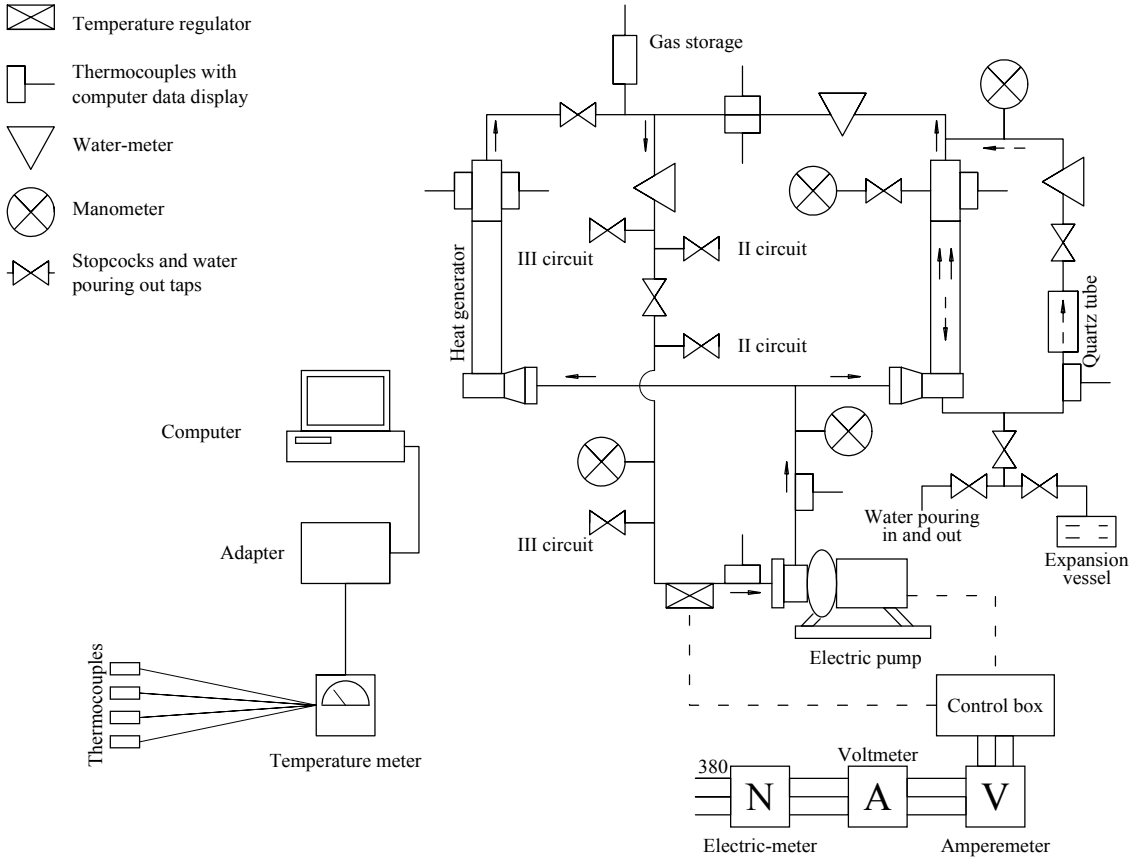


Figure 3. The general circuit of the stand

While studying the influence produced by different kinds of energy effects on water (eddy effects, cavitation, hydroshock, various resonance phenomena, formation of anomaly supersaturated solutions in water that are stabilized through energy actions) we have succeeded in reaching so far a short - term effect when under specific conditions the process of heat transfer from cool walls of a pipeline to warmer water running through it took place (figure 4). This process repeats in a stable way when the same experimental conditions are applied.

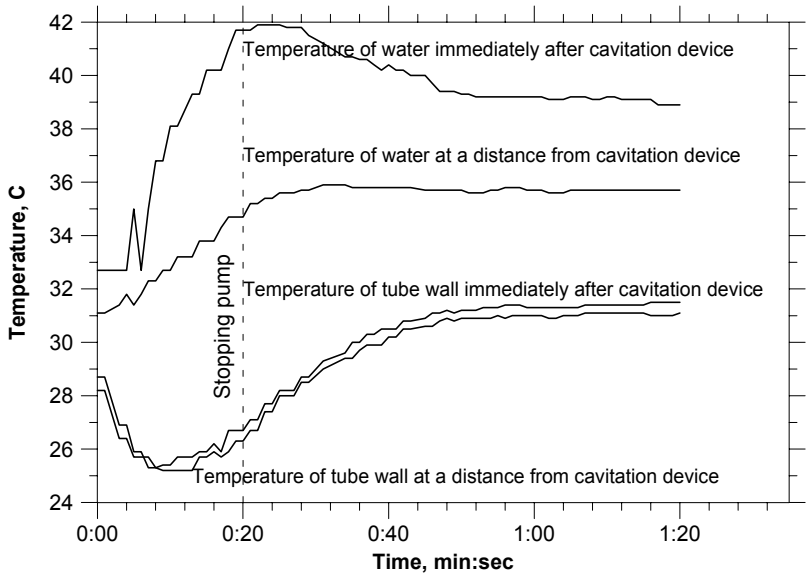


Figure 4. Effect of heat transfer from cold body to hot one with aqueous mixture passing through special eddy cavitation device.

The heat transfer from a cool body to a warmer one does not break the second law of thermodynamics since here the work is spent off. The operation of refrigerators is based on this principle, however in this case to transfer heat an intermediate link - a coolant - working body is needed which with the application of work to it circulates in a force way through a circuit, takes heat from a cool body and transfers it to a hot one. In our experiments, however, nothing was available between warm water and cool walls and Physical Vacuum acted as a coolant. Thus, PV is a medium in which energy processes are reflected that proceed in material bodies thereby the thermodynamic system converts automatically from the closed system to the open one.

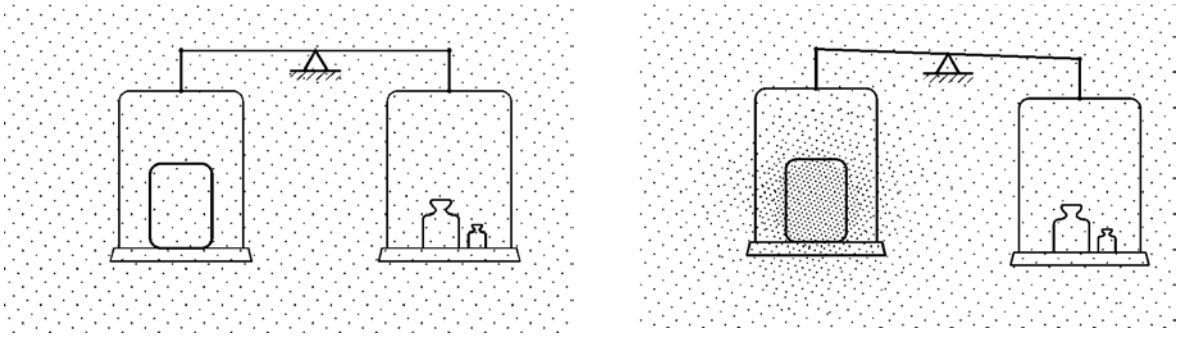
3. Weight Changes of Bodies upon Interaction with Physical Vacuum

As it was pointed out in the beginning of the paper any energy action on a matter, viz., deformation, heating etc, via oscillations of atoms lead to the intensification of oscillations of energy nodes of Physical Vacuum lattice and, consequently, to an increase of the energy density of the latter.

This effect has to lead to a reduction in weight (not mass) similarly to the effect of hydrostatic weighing in a medium having an elevated energy density (figure 5). A body of a matter as if comes up to the surface in the medium. And the lower is the density of bodies, i. e., the higher is the relative volume of Physical Vacuum that they occupy the higher has to be the effect of "hydrostatic weighing" at the same degrees of energy action, i. e., a decrease in the weight of bodies.

From the scientific viewpoint, the reduce weight of bodies looks like a decrease in gravitational interaction. Einstein considered gravitation to be a space distortion. In his view it is the space deformation that explains gravitation. The increase in the energy density of PV makes the space more deformation resistant, hence, reducing gravitational interaction.

Astrophysicist N. Kozyrev [8, 9] was the first to reveal weight changes of bodies upon deformation. Though, he to think that it is but an irreversible deformation that might give rise to this effect with the attendant change in a body mass. Little is known about his experiments yet since the effects of weight changes were low (0.001-0.001% of a body weight) and the effect was not explained theoretically.



a b

Figure 5. Schematic that explains effect of body weight reduction with an increase of Physical Vacuum energy density:
a - original state, b - after energy introduction into Physical Vacuum.

In our experiments we observed the effects of weight changes upon various energy actions on a matter, viz., heating and cooling of samples, discharges of capacitors, ice thawing, crystallization of Wood's alloy, electric bulb shining, sand glass work, as well as elastic and plastic deformations of various materials. Since in experiments several factors were often in action, the first group of experiments was carried on to produce a purely qualitative effect, viz., change of weight in one or other direction. In all the accomplished experiments when energy was introduced into a body (heating, deformation etc.) the weight decreased, while in reverse processes, viz., cooling, crystallization, it increased which corroborated the above hypothesis that weight change of bodies is similar to the effect of hydrostatic weighing in an environment of higher or lower energy density. More noticeable weight changes took place upon the heating of bodies (up to 0.2% of specimen weight).

More simple in terms of procedures with minimal influence of side factors on the purity of experiments proved to be experiments using deformation effects, that is why, they were conducted more systematically on materials having different densities, i. e., lead, stainless steel, aluminium and plastic. Since the effect of a decrease in weight of lower density bodies, viz., aluminium and plastic proved as it was expected to be stronger, the more accurate experiments were performed on aluminium plates 4.6 g in weight and plastic cylinders 6.9 g in weight. The measurements for the most part were conducted on laboratory scales VLR-200 at the error of 0.00005 g. Aluminium plates were subjected to plastic deformation while plastic cylinders were subjected to both plastic and elastic deformations during 10-15 s. The maximal weight change in the plates made up 0.0014 g, while that of the cylinders was 0.0048 g which in relative per cent amounted to 0.03% and 0.07%, respectively. The results of one of the experiments are illustrated in figure 4.

A specimen was pre-weighed, subjected to deformation for 10-15 s and weighed. Further on during the whole experiment the specimen remained on the scales. During the first seconds after deformation the maximal decrease in its weight was observable. Then during 10-15 min the weight was essentially recovered which corroborated the purity of the experiments.

The recovery of the weight by the specimens with time took place due to a gradual recovery of the energy density by PV, i. e., a decrease in the intensity of its oscillations induced by the action of a material body.

The weight decreased after both elastic and plastic deformations. According to the first approximate estimates the extent to which the weight changed depended not so much on the amount of the energy action but on its power.

It is to be emphasized that the recorded weight decrease exceeds the measurement error by more than an order of magnitude.

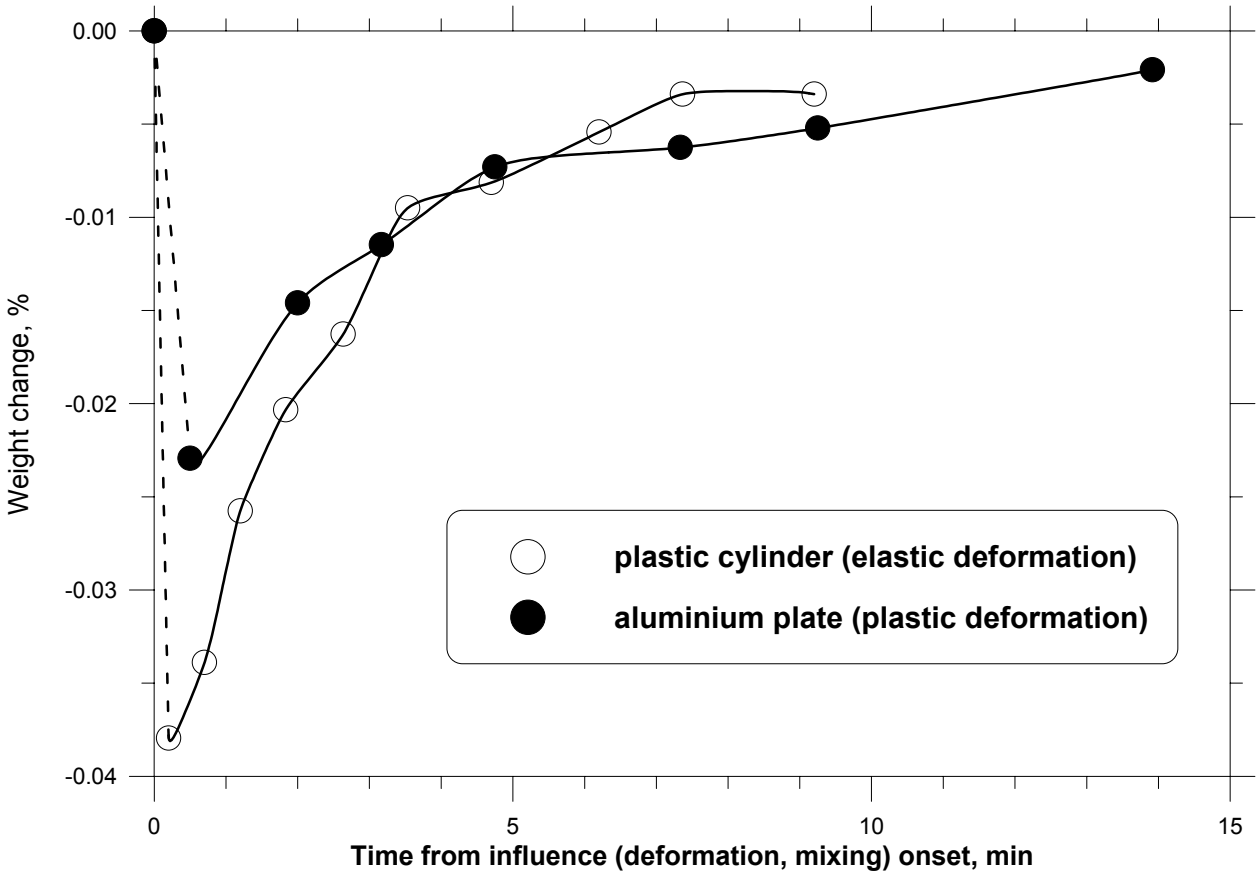


Figure 6. Weight changes of bodies having different densities subjected to elastic or plastic deformations of aluminium plate (plastic deformation) and plastic cylinder (elastic deformation)

4. Weight Changes of Bodies with Increase in Entropy of Mixing

According to our hypothesis an increase in the entropy of mixing has also to lead to an increase of Physical Vacuum energy density and as distinct from the previous experiments it is irreversible. That is why, in the next series of the experiments we studied weight changes upon dissolution of sugar syrup in water. This process does not alter the amount of the internal energy of the system (neither release nor absorption of heat) but leads to an increase in the entropy of mixing. First sugar (~7g) was dissolved in water (~30 g). In this case the relative decrease of the weight of the mixture made up 0.009%. However, due to an alteration of the phase state of one of the components, viz., the solid state of the sugar transformed to the liquid one, this result was superimposed by the effect of the phase transition. That is why, in the next experiments the syrup was half diluted with water.

As distinct from the previous experiments (see ch. 3) the weight of the mixture was gradually decreasing as the diffusion process of mixing proceeded (figure 7). After approximately 5 minutes the degrease of the weight reached the relative value of 0.04% and afterwards did not significant vary with time. This points to the irreversible process and to the fact that PV acquires another higher energy state as the entropy of mixing increases through the transfer in it an excess energy upon mixing and retains this state during the time of the mixture existence.

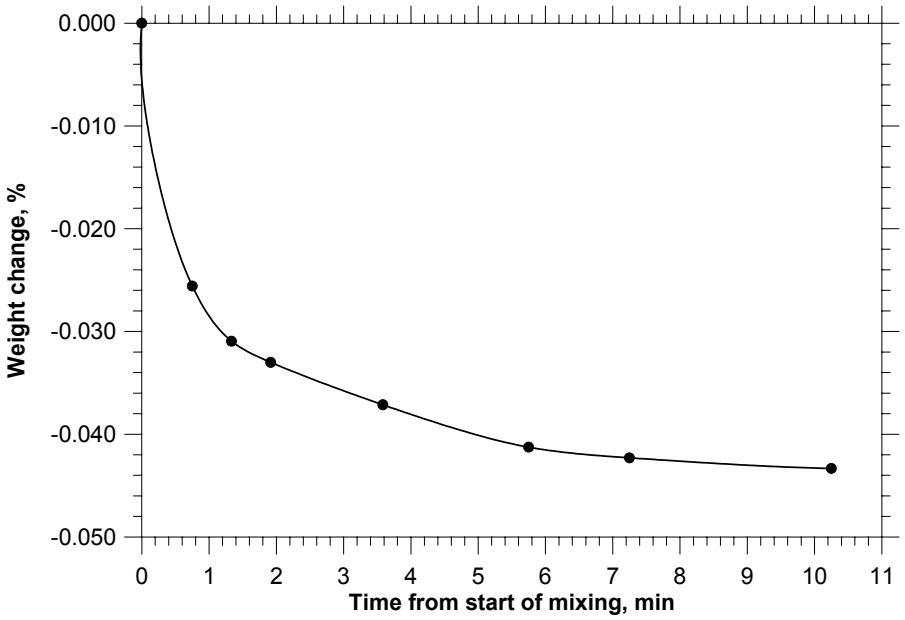


Figure 7. `Variation in weight with an increase in entropy of mixing (upon sugar syrop-water mixing)

5. Physics and Energy Nature of Entropy of Mixing

The acquired experimental results require an answer to two questions. What is the mechanism of increasing the energy density of PV as the entropy of mixing increases and what is the physical nature of the entropy of mixing?

The entropy value is known to be in proportion to the logarithm of thermodynamic probability of the system states that naturally increases upon dissimilar atoms mixing. That is why, the increase in the energy density of Physical Vacuum with an increase in the entropy of mixing is explained by an increase in the number of the system microstates, hence, by an increase in the number and the amplitude of oscillations of the solution atoms and the related oscillations of the PV energy lattice. A kind of a process involving the energy transfer from a material body to Physical Vacuum is proceeding as the energy density of the latter increases, thus, retaining the overall energy of the open system (matter plus Physical Vacuum) invariable.

Energy release (absorption) in matter — Energy release (absorption) in **Physical Vacuum**

$$\Delta F = \Delta E - T\Delta S, \qquad \Delta F \leq 0$$

The system conversion to the stable state, i. e., the minimum energy state, is always attended with a release of an excess energy usually in the form of heat. Mixing is the same spontaneous process, i. e., the process that leads to a lower energy of a system. However, the excess energy is released not in a material body but in Physical Vacuum surrounding a body and constantly related to it.

Hence, the second law of thermodynamics upon the conversion to an open system, i. e., a matter plus Physical Vacuum, acquires an extra physical sense as the law of the energy conservation but not only as a law that determines the equilibrium of a thermodynamic system. That is why, in the free energy equation the first term, i. e., the internal energy (ΔE) defines the energy processes proceeding in a matter itself and the second term ($T\Delta S$) which comprises the entropy defines the energy processes related to the interaction between this matter and Physical Vacuum.

Thus, it becomes clear why physical and chemical processes in which the internal energy of the system (ΔE) increases are to proceed spontaneously. The overall decrease in the system energy is achieved through a higher than ΔE and equal to $T\Delta S$ release of the energy into Physical Vacuum.

6. Conclusion

A novel notion of the physical nature of mixing entropy is suggested.

The results have been acquired experimentally that corroborate the hypothesis of the matter – Physical Vacuum interaction. These are:

- a heat flow from a cool body to a warmer one;
- variations in weight of bodies effected by energy (deformation, heating etc);
- variation in weight of mixture upon dissolution.

The latter result indicates that an increase in the entropy of mixing like any other spontaneous process leads to a decrease in the energy of a system and, hence, to a release of excess energy, however, not in a material body, but in PV, which results in an increase of PV energy density.

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