

MPEMBA EFFECT

(According to “Hypothesis on MATTER”)

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Abstract: Mpemba effect is the result of difference in the rate of inter-atomic movements during cooling stages of macro bodies with different initial temperatures.

Keywords: Heating, Cooling, Latent stage, Mpemba effect, Hypothesis on MATTER.

Introduction:

“Hypothesis on MATTER” describes an alternative concept. According to this concept; on cooling, matter and energy content of all atoms in a macro body increase and their volume decrease. Increase in matter content increases apparent attraction due to gravitation between atoms in a macro body. During cooling, atoms of a macro body move nearer and inter-atomic distances in the macro body decrease. Conversely; on heating, matter and energy content of all atoms decrease and their volume increase. Reduction in matter content reduces apparent attraction due to gravitation between atoms in a macro body. During heating, atoms of a macro body move farther and inter-atomic distances in the macro body increase. These conclusions, expressed in the ‘Hypothesis of MATTER’ are contrary to current physical theories. For details, kindly refer to [1]. Primarily, it is the inter-atomic distances that determine the physical state of a macro body. Matter contents of atoms/molecules determine inter-atomic distances.

Mpemba effect:

If two equal volumes of water, one slightly warmer than the other, are placed in similar external conditions to freeze, the warmer water is noticed to freeze before the other. This phenomenon is called mpemba effect (named after Erasto B. Mpemba, who noticed this phenomenon first).

Let us consider two identical liquid macro bodies, A and B, being cooled under similar surrounding conditions. Let the freezing temperature of the body material is $t_0^\circ\text{C}$. Let the initial temperature of macro body, A, is $t_1^\circ\text{C}$. As the cooling process of the macro body starts, atoms in it are moved towards each other under increasing acceleration due to gravitation. As and when the temperature of the macro body reaches the freezing point $t_0^\circ\text{C}$, neighbouring atoms in the body would have reached the proximity corresponding to the freezing state of the body material. The macro body changes its physical state from liquid to solid.

Let the initial temperature of macro body, B, is $t_2^\circ\text{C}$, slightly higher than the initial temperature of macro body A. As the cooling process of the macro body starts, atoms in it are moved towards each other

under increasing acceleration due to gravitation. As and when the temperature of the macro body B reaches temperature $t_1^\circ \text{C}$, atoms in the body have already gained certain resultant velocity towards their neighbours. Although the matter contents and their mutual apparent attraction due to gravitation, at temperature $t_1^\circ \text{C}$, are equal to those of atoms in macro body, A, during their initial stage of cooling, these atoms are already under certain velocity towards their neighbours. Further motions of these atoms are governed by accelerations due to apparent gravitational attraction, as in the case of body 'A', over and above their current velocities. Average velocities of atoms in the body 'B', during its transition from temperature $t_1^\circ \text{C}$ to $t_0^\circ \text{C}$ are greater than the average velocity of atoms in body 'A', during similar transition. Hence, the time taken by body 'B' (which is initially at slightly higher temperature $t_2^\circ \text{C}$) to change its temperature from $t_1^\circ \text{C}$ to $t_0^\circ \text{C}$ is less than the time required for the body 'A' to change its temperature through the same range.

Rate of cooling (absorption of matter) by a macro body depends on the difference between the surrounding pressure (room temperature) and the internal pressure (temperature) of the macro body. Whatever be the temperature of a macro body at any stage, its rate of cooling depends on the initial conditions (difference between room temperature and temperature at the center of the macro body, when the macro body has started its cooling process). That is to say, that the rate of cooling of a macro body does not directly depend only on its temperature difference with room temperature at any instant, but it depends also on the initial difference between temperature of the macro body and the room temperature, when the cooling process started. In the same room temperature conditions, a slightly warmer macro body will cool down faster than a slightly cooler macro body. If the initial temperature difference between the macro bodies is very little, total time required for a hotter body to cool through certain range of temperature may be less than the total time required for a cooler body to cool through the same range of temperature. Thus, under same external conditions, slightly warmer water freezes faster than identical quantity of cooler water. This phenomenon is called the 'mpemba effect'.

Similar actions take place during heating of macro bodies also, but in reverse order. Slightly cooler macro body may reach next latent stage before slightly warmer macro body, under identical surrounding conditions. Thus, it is possible that slightly cooler macro body reaches higher latent stage earlier than slightly warmer but identical macro body under similar surrounding conditions.

Reference:

- [1] Nainan K. Varghese, *Hypothesis on MATTER* (second edition), (2008).
<http://www.booksurge.com/Hypothesis-on-MATTER-Second-Edition/A/1419689789.htm>
- [2] Nainan. K. Varghese, ARTICLES, <http://wbabin.net/papers.htm#Varghese>

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