Journal of Theoretics Vol.4-5

Cohesion and Structure of Liquid

Zeljko Prebeg
Vierzigmannstrasse 17-19
91054 Erlangen, Germany
zeljkoprebeg@hotmail.com

Abstract: This paper will show that the structure of a liquid depends upon the degree of freedom that the molecules have for motion as determined by the number of coordinates that are occupied by cohesion.
Keywords: states of matter, liquid, cohesion.

Introduction

In previously paper[1], it was shown that the structure of matter depends upon degrees of freedom for free molecular motion. Molecules in the solid state do not have the degrees of freedom for free molecular motion, while in the liquid state, the molecules have two coordinates of free space for molecular motion and the molecules in the gas phase have three coordinates of free space for molecular motion. This paper will examine cohesion as fundamental force and show the structure of liquid.

Cohesion

On the base of the diatomic hypothesis, it has been shown that a condensation force exists between molecules. In the solid state this force occupies three coordinates of space while in the liquid state this force occupies only one coordinate of space, and while in the gas phase this force does not have significant influence. It must be said that the term "condensation force" is often used for term "cohesion" but because the term cohesion is better understood in the world of science, I will use the term cohesion.

Cohesion is fundamental force. Under the influence of cohesion, molecules and atoms form bodies. It would be impossible to imagine the forming of any object, from the stars to the agglomerates of molecules, without the influence of this force. It was showed that

$$\textbf{cohesion force} \sim \textbf{(intermolecular distance)}^{3}$$

The intermolecular distance in solid or liquid state of matter depends upon the dimension of molecules and this force is somewhat proportional to the size of the molecules. Cohesion brings molecules close together, but under the influence of the repulsive electro-magnetic forces between the outer electron pairs, the molecules oscillates around equilibrium state. (Figure 1.)

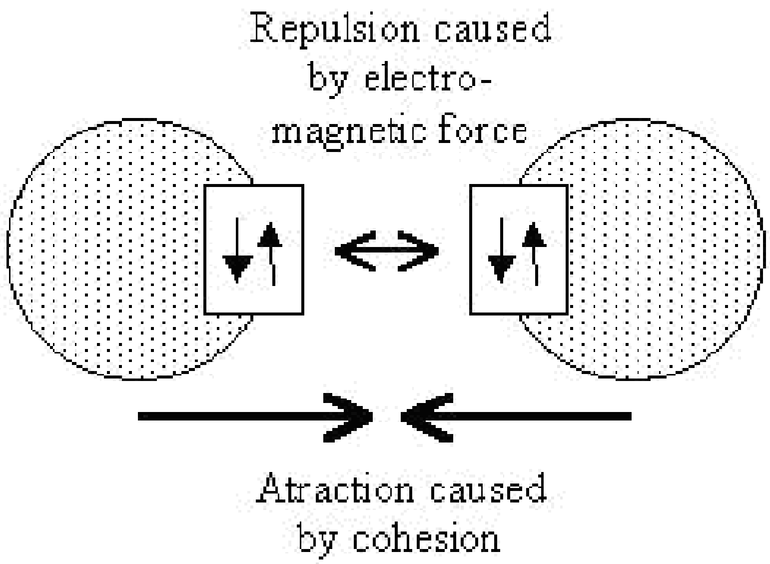

Figure 1. Oscillation of molecules caused by cohesion, causes an attraction of molecules and the electromagnetic repulsion of the outer electron pairs.

The Structure of Liquid

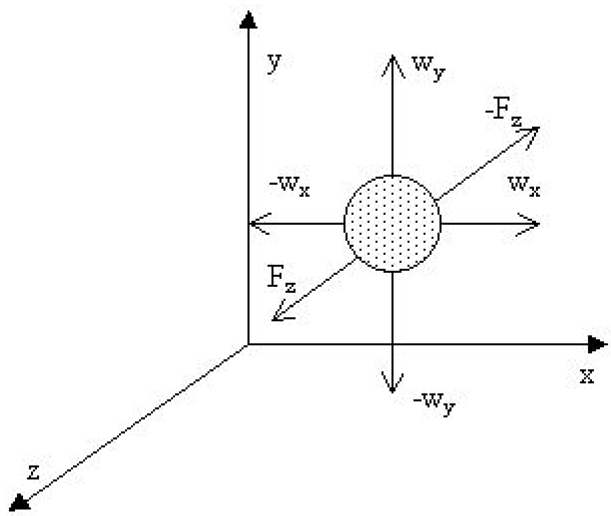

Figure 2. Molecule in liquid state

Figure 2. This figure shows a molecule in the liquid state. Two coordinates of space are free for motion while the one coordinate is occupied by cohesion. This organization of molecules in space yields the possibility of forming two models for a liquid, a surface model and string model.

Surface Model of Liquid

A Surface model of a liquid is formed on the base of the hypothesis that translation is only form of molecular motion. In this model, molecules are in free motion on the surface. The cohesion force is dislocated. That means that the force does not act between two molecules but rather between two surfaces. (Figure 3.)

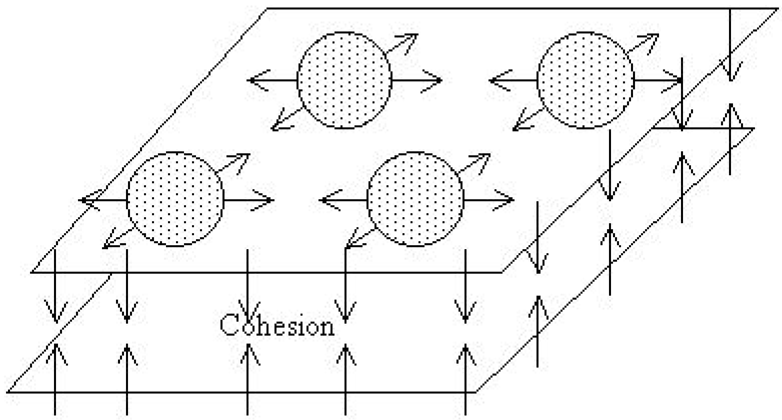

Figure 3. Surface model of liquid

String Model of Liquid

The String model of a liquid is based upon the hypothesis that rotation is the only form of molecular motion that occurs in a liquid. In this model, the molecules are connected under the influence of cohesion, and subsequently form a string structure. This string is exhibits rotational motion. (Figure 4.)

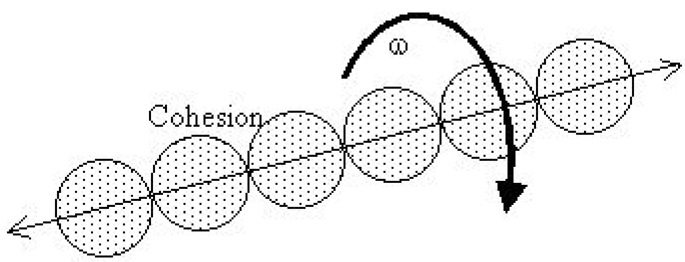

Figure 4. String model of liquid

Discussion

Both of these models describe the liquid state of matter and can be utilized in the analysis of liquids. The influence of dislocated cohesion force demonstrated in the surface model can be treated as friction. In that case, the motion of the molecules is friction.

The String model predicts the structural organization of liquids. For example, in multicomponent liquids, it can predict the arrangement of different molecules in a string (primary structure), conformation of the molecules (secondary structure), and the shape of string (tertiary structure), as shown in Figure 5 below.

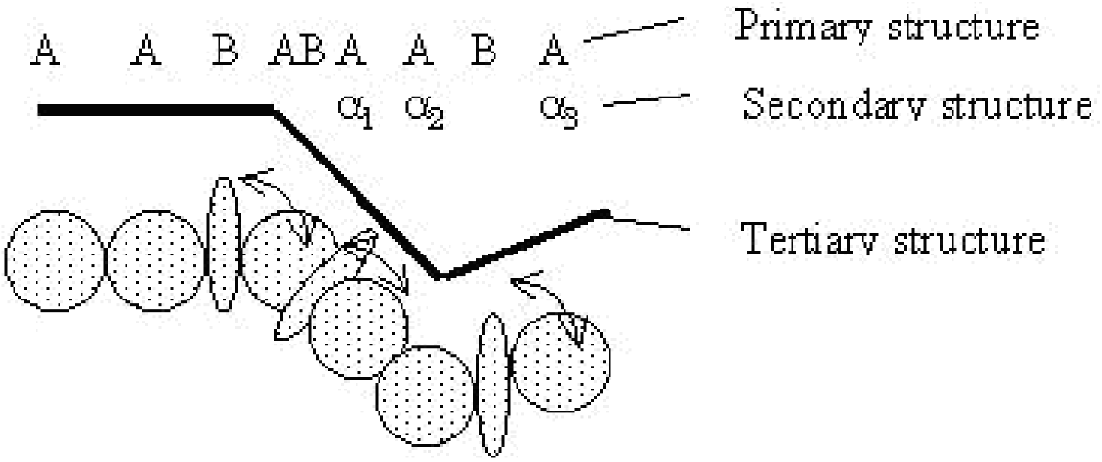

Figure 5.

Conclusion

Depending upon the application, one of these models will be preferred. But, for better understanding of the structure of liquid it will be necessary to develop experimental techniques for better delineation.

Acknowledgements

I wish to express my acknowledgement to Journal of Theoretics.

References

1. Z.Prebeg, Diatomic Hypothesis and Calculation of Condensation Force, Journal of Theoretics, Dec/Jan 2000-1 Vol. 2, No. 5.

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