International Journal of Progressive Sciences and Technologies (IJPSAT)
ISSN: 2509-0119.

http://ijpsat.ijsht-journals.org
Vol. 21 No. 1 June 2020, pp. 318-320

The Peculiarity of Thermal Motion in Polyvinylidene Fluoride

A.A. Rakhmankulov, UH Turdieva, OH Panjiev, ZE Kurbanova, D.KH.KHamdamov

Karshi Engineering Economic Institute

Abstract – In this paper, we present a strudy of The Peculiarity of Thermal Motion in Polyvinylidene Fluoride. One of the most important tasks of modern thermophysics and molecular physics is to establish the interconnection of thermophysical properties (TFS), in particular, thermal conductivity (ʎ), polymer materials with their structure at different levels of its organization and the nature of thermal motion. Knowing this relationship makes it possible to deeper and comprehensively analyze the mechanism of heat transfer in polymer composite materials (PC), which will help to accelerate the solution of the problem of obtaining polymer materials with previously specified TPS. Polymeric materials are provided with the growing needs of various industries and, primarily, mechanical engineering, as well as the electrical industry, electronics and other industries, in several directions: new materials are being developed and multi-ton polymer materials manufactured are being modified serially by chemical industry enterprises.

Keywords – Thermal Motion, Polyvinylidene Fluoride, thermophysical properties (TFS), TPS, composite materials (PC).

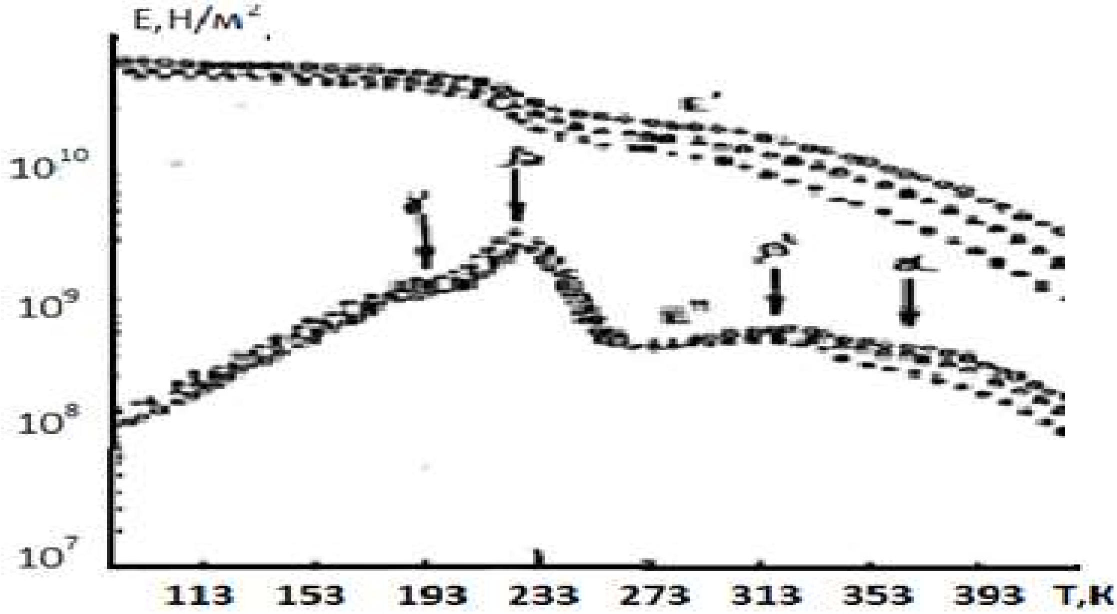
One of the most important tasks of modern thermophysics and molecular physics is to establish the interconnection of thermophysical properties (TFS), in particular, thermal conductivity (ʎ), polymer materials with their structure at different levels of its organization and the nature of thermal motion. Knowing this relationship makes it possible to deeper and comprehensively analyze the mechanism of heat transfer in polymer composite materials (PC), which will help to accelerate the solution of the problem of obtaining polymer materials with previously specified TPS. Polymeric materials are provided with the growing needs of various industries and, primarily, mechanical engineering, as well as the electrical industry, electronics and other industries, in several directions: new materials are being developed and multi-ton polymer materials manufactured are being modified serially by chemical industry enterprises.

The main trends that currently exist in polymer materials science are precisely the development of techniques for the modification of polymers produced by the industry. Modification can be carried out at various stages of the preparation or processing of the polymer by chemical and physical methods. It is widely recognized, in particular, due to its relative technological simplicity, efficiency and economy, the physical method of introducing various fillers into the polymer.

Among the CP, fluorine-containing polymers (fluoroplastics) have a special place, having a complex of unique physicochemical properties, and therefore are quite promising materials for use as a polymer component of PCM. The use in the sectors of the national economic complex of the Republic of Uzbekistan involved in the production, processing of PCM and the operation of products made from them, as well as the results of studying the TPS of these materials, ultimately saves the country's material and energy resources. The nature of the thermal motion in PVDF was studied by various methods [1,2,3-6.] When studying the PVDF phase at frequencies by dielectric spectroscopy, three relaxation transitions were established at temperatures of 373 K, 233 K and 203 K, respectively [3].

The four main relaxation transitions in the PVDF phase were determined by dynamic mechanical spectroscopy [7]. Figure 1 shows the temperature dependences of the dynamic Young's modulus determined along and perpendicular to the crystallization direction of the sample obtained by isothermal crystallization.

The relaxation that begins at low temperatures corresponds to the amorphous phase and the limited motion of the chains, while specific relaxation to chains rotates in the amorphous region and is associated with vitrification; it corresponds to the microbrown motion of segments [5, 8, 9.] Of the amorphous region. relaxation is associated with the movement of molecules that changes the dipole direction only along the axis of the chain / and is not perpendicular to it. It is possible that the relaxation behavior of PVDF changes not only at different temperatures, but also depends on the methods for studying these properties.



Drawing. 1. Temperature dependences of the dynamic mechanical characteristics of PVDF: storage modulus (E’) and loss modulus (E”) of isothermally crystallized and directionally crystallized samples of the α-phase of PVLF. O-parallel; 0-perpendicular; Δ-isothermally crystallized sample

T,K	113	153	193	233	273	313	353	393	
E,H/м^2	10^7	10^8	10^9		11^{10}	10^{11}			

The nature of the thermal motion in PVDF can also be judged by the change in the temperature of the polymer transitions and other thermodynamic parameters. The phase grown from the melt seams at higher temperatures, and the phase that appeared at the transition in the PVDF solid phase is the highest melting point [7]. In addition to the possible coexistence of polymorphic modifications in it, the PVDF melting process is also significantly affected by both pressure and other factors, in particular, the presence of h – h and t – t defects [7].

The thermal destruction of PVDF in the solid phase proceeds unequally, depending on the polyamorphic form. It was found that polar and forms are much easier to undergo destruction than the non-polar phase or melt. At these temperatures, the phase is especially rapidly destroyed.

The physical properties of PVDF reflect the position occupied by the polymer in the gap between polyethylene (PE) and polytetrafluoroethylene (PTFE), based on the number of fluorine atoms per monomer unit of the macromolecule.

For polymers of this series, the density, melting point, and resistance to oxidation and chemical influences rapidly increase in the fluorine content. In terms of resistance to ultraviolet and rays at 100 Mrad, PVDF is an exception. PVDF has a very good resistance to weathering and flexibility. In PVDF, there is practically no deterioration in mechanical properties after many years of operation in the open air; therefore, they are often used for coating the external surfaces of buildings. PVDF is also distinguished by its mechanical properties among ordinary crystalline polymers: it occupies the second place after polyoxymethylene in terms of tensile strength, in flexural and compressive stresses, in stiffness and hardness, and has the highest impact strength, high coefficient flowing (80-90% with a thickness of 100 microns) in the visible region of the electromagnetic spectrum. Thus, it can be used for coatings transmitting sunlight, PVDF also has good chemical resistance; even at high temperatures (363 K) inorganic acids, corrosive materials (halogens, oxidizing agents), weak bases and salts, aliphatic, aromatic and chlorinated solvents do not act on PVDF.

Unlike other polymers of fluorinated ethylene, the electrical properties of PVDF and PVDF-M do not allow them to be used as high-frequency insulation, however, the large values of the dielectric constant, the presence of ferroelectric and pyroelectric properties make promising the use of polymer and compositions based on it in acousto- and pyroelectric converters [12].

REFERENCES

[1] Godovsky Yu.K. Thermophysics of polymers. -M .: Chemistry, 1982.- 280 p.

[2] Lovlnger Andrew J. Cristallization of the pbaseofpoly (vlnylldenefluoride) from the melt. Polymer, 1981, 22, No. 3, pp. 412-413.

[3] Kakutani M. Dielectric absorption of oriented poly (vlnylldenefluoride) .- I. Polym. Sci., A-L, 1970, 8, pp. 1177-1183.

[4] Uapo S. Dielectric Relaxation and Molecular, Motlon In poly (vlnylldenefluoride), I. Polym. Sci., A-L, 1970, 8, pp. 1057-1062.

[5] Kuleshov I.V. Phase and relaxation transitions in polymers. - M.: VINITI, 1984, p. 3-65. - (Results of science and technology. Ser. Chemistry and technology of high molecular weight compounds) VINITI; T. 19.

[6] Buller K.U. Heat- and heat-resistant polymers: Per. with him. / Ed. Ya.S. Vygodsky. - M.: Chemistry, 1984 - 1056 p.

[7] Lovinger Andrew I. .. Polyvinilidenftoride. "Dey,! Grust. Polym. " London, New Woigk, 1982, 195-273.

[8] KlnshA. PVDF-Nuevoiermoplasticoenla. construcion de tubertas u equipas "Quimeind" 1983,29, No. 4, pp. 279-283.

[9] Fournat C., BrenikW.I. New Wegrun ver Starhungvon PlDE-Rohrem durch GFX Chem – Tebn. (BRO), 1983, 12, No. 32, 77-78, 80-81.

[10] Perepechko II Properties of polymers at low temperatures. -M .: Chemistry, 1977 .-- 272 p.

[11] Frest W.M. and LucaD.A. The morphology and thermal response of high temperature-crystallized poly (vlnylldenefluoride) .- I. Appl. Phys., 1975, vol. 46, No.10, pp. 4136-4163.

[12] Rakhmankulov A.A. The effect of dispersed fillers on the structure and thermal conductivity of unmodified and modified polyvinylidene fluoride: Dis. ... Candidate of Physical and Mathematical Sciences; UK.-Kiev: 1987 .-- 205 p.