



Thermophysical Properties of Polymers

By Yuli K. Godovsky

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Among various branches of polymer physics an important position is occupied by that vast area, which deals with the thermal behavior and thermal properties of polymers and which is normally called the thermal physics of polymers. Historically it began when the unusual thermo-mechanical behavior of natural rubber under stretching, which had been discovered by Gough at the very beginning of the last century, was studied 50 years later experimentally by Joule and theoretically by Lord Kelvin. This made it possible even at that time to distinguish polymers from other subjects of physical investigations. These investigations laid down the basic principles of solving the key problem of polymer physics - rubberlike elasticity - which was solved in the middle of our century by means of the statistical thermodynamics applied to chain molecules. At approximately the same time it was demonstrated, by using the methods of solid state physics, that the low temperature dependence of heat capacity and thermal expansivity of linear polymers should follow dependencies different from that characteristic of nonpolymeric solids. Finally, new ideas about the structure and morphology of polymers arising at the end of the 1950s stimulated the development of new thermal methods (differential scanning calorimetry, deformation calorimetry), which have become very powerful instruments for studying the nature of various states of polymers and the structural heterogeneity.

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