GENERAL SUMMARY

Accurate thermodynamic data of polymers and their solutions is needed for process control application and to test the recent theories of polymers and polymer solutions. Ultrasonic velocity is being used to evaluate the compressibility, which is prime thermodynamic parameter. Several workers have tested the recent liquid state theories through thermodynamic parameters derived from ultrasonic studies on polymer solutions. These studies are also used to predict the behavior of the polymers.

In the present work an attempt has been made to calculate the thermal expansion of polymeric materials polystyrene, polymethyl methacrylate, polyvinyl acetate and polyvinyl chloride using the Van der Waal's volume of the atomic groups. Thermodynamic properties of the four polymer solutions in toluene and diaxane. The polymer blend properties have been evaluated through ultrasonic studies on the solutions. Theoretically evaluated results through Flory theory are corroborated with the experimentally derived parameters.

Chapter 1 deals with the introductory aspects of polymers in general. Preliminary ideas on polymers and their classification is presented. Types of polymerization reactions and the general methods of preparation are briefly discussed.

Chapter 2 deals with the preparation of the polymers polystyrene (PS), polymethyl methacrylate (PMMA), polyvinyl acetate (PVAC) and polyvinyl chloride (PVC) including their monomers. The solubility aspects of these polymers (in organic solvents), their mechanical properties and uses are presented.

Chapter 3 deals with the theoretical method used for the determination of thermal expansion coefficients of the four polymers (in solid state). A brief literature survey on (experimental) thermal expansion of polymers is discussed. The theoretically evaluated values are compared with the literature values.
Ultrasonic measurements as reported in polystyrene and polymethyl methacrylate solutions prompted us to investigate the thermodynamic studies. For example ultrasonic studies in PS in solvents like toluene was reported to be non-linear as a function of concentration.

In the present work an attempt has been made to investigate the thermodynamic data of four polymer solutions in toluene and three polymer blend solutions (PMMA-PS, PMMA-PVA, PVA-PVC) in toluene and dioxane at 25°C.

Chapter 4 describes the experimental techniques adopted in the present work. Methods of evaluation of thermodynamic properties of polymers and their solutions is discussed. Polymer blends are physical mixtures of structurally different polymers which interact through secondary forces with no covalent bonding. The blending importance has increased because it has become a useful approach for the preparation of materials with new desirable properties, absent from the component polymers. The blending of polymers may result in reduction of cost, improved processing and also may enable properties of importance to be maximized. However, the manifestation of superior properties depends upon compatibility or the miscibility of homopolymers at molecular levels. Depending upon the degree of molecular mixing, the blends may be categorized as totally miscible (compatible blends), semi-miscible (semi-compatible blends) and immiscible (Incompatible blends). For the present work blend solution of PMMA-PS (incompatible), PMMA-PVA (compatible) and PVA-PVC (semi-compatible) have been established in toluene and dioxane. The ultrasonic studies on blends in toluene and dioxane of present investigation demonstrate their basic nature.

The salient aspects of the Flory theory and the method of evaluation of thermodynamic properties of polymer solutions and solution blends using Flory theory are presented in Chapter 5. However this application requires experimental results of basic components or the component solutions as the case may be. The theoretically determined thermal coefficient of expansion and compressibility evaluated using experimental velocity & density and literature values of heat capacity are used for Flory theory.
Chapter 6 describes the use of LOTUS work sheet for the prediction of thermodynamic parameters using Flory theory. The entire presentation could not be presented. Only the outlines of the methods are provided with two specific examples.

The nature of polymer solutions and blends in toluene and dioxane studied in the present investigation are discussed in chapter 7. The volume change on solution, the heat on solution and other thermodynamic parameters evaluated using Flory theory are discussed. A critical discussion of the solutions studied in this work along with the studies of other workers is presented in this chapter. The success of the Flory theory for polymer solutions is indicated.