

232c Extending Thermodynamic Plasticizer Models to Ionic Liquids

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With the pressures of high performance, environmentally benign and increased lifetime on new flexible plastics, novel plasticizers have begun to emerge. Previously we investigated several imidazolium, ammonium and phosphonium-based ionic liquids (ILs) as plasticizers for PVC and PMMA. It was observed that ILs are capable of rendering comparable, and in some cases better, thermal, mechanical, leaching and migration properties to these polymers as done by the traditional plasticizers DEHP, DIDP and TOTM. The current focus of our research is understandably the thermodynamics involved in polymer-IL system to be able to predict IL structures that will likely be compatible with different polymers. Compatibility between a polymer and plasticizer was studied in terms of parameters including the solubility parameter (δ), Flory-Huggins interaction parameter (χ) and solution temperature (T_m). δ was calculated from the correlations available in literature, from surface tension of the ILs and the heat of mixing of the two components. χ was calculated from the heat of interaction, and by UNIFAC-FV method by measuring the activity coefficients, and also from the δ values. T_m for different polymer-IL system was determined according to a standard industry test, DIN 53408, which further produced values of δ and χ . Since the values differ slightly depending on the method used and assumptions made, approaches were taken to simultaneously evaluate δ , χ and T_m . A comparison of these values was performed for the ILs and the traditional plasticizers to achieve a better understanding of the efficiency and feasibility of ILs to be used as plasticizers for commercial polymers. The relationship developed here can also be extended to other areas of plasticizer development, such as soy bean oil and other biodegradable additives.