RHEOLOGICAL AND THERMAL PROPERTIES OF SOLUTIONS OF POLYSTYRENE MELTS AND A BLOWING AGENT

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The increasing interest in the use of cellular polymers is promoted by the need of sustainable materials which lead to a reduction of energy and material cost. An efficient development of polymer foams requires a deeper understanding of processing and end-use properties of cellular polymers. In foam extrusion of polymers, the polymer melt is mixed with a blowing agent and the processing properties are determined by the thermal, transport and rheological properties of the polymer/blowing agent solution. For example, the viscosity of the polymer melt can be strongly reduced by the addition of a low weight fraction of a blowing agent. In this contribution, we discuss the thermal, transport and rheological properties of solutions of polystyrene melts with carbon dioxide. A commercial rotational rheometer which is equipped with a pressure cell is used for the rheological investigations. We study the transient shear rheology and test superposition principles of the rheological properties with respect to time, temperature, pressure and concentration of the blowing agent. These measurements allow us to determine the concentration shift factors and the diffusion coefficient of carbon dioxide in a polystyrene melt. In addition, results of differential scanning calorimetry (DSC) measurements under high pressure are presented. We compare the values of the glass transition temperature as determined by DSC experiments and by the rheological experiments.