Supercritical Fluid Tuning of Thermophysical Properties of Either Foamed or Nanoscale Polymeric Structures

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Basic thermodynamic principles and new experimental techniques allow in depth modifying the molecular organization of polymeric materials. Two examples are selected to illustrate the use of supercritical fluids to further enhance the place of polymers in materials science, using clean-safe processing to produce “new” materials of practical interest (in the present case polymer foams and 3D templates for microelectronics). The thermodynamic control of the different processing steps includes the measurements of gas sorption/solubility, swelling of polymers, interactions gas-polymer, and thermophysical properties of polymers under gas sorption, as well as the investigation of state transitions (melting and glass transitions). The experimental part deals with polymers like polyethylene, polyvinylidene fluoride, and amphiphilic di-block copolymers, the supercritical fluids being either carbon dioxide or nitrogen. In this context, experimental techniques like vibrating wire-*pVT* technique for sorption/swelling measurements and scanning transitiometry for materials characterization are key instruments.