Specimen

POLYMER MICROSTRUCTURES: ELABORATION, MODIFICATION AND CHARACTERISATION BY SUPERCRITICAL FLUIDS

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Micro- or nano-organisation naturally exits in native polymers. It can be modified by combination of three constraints, thermal, hydrostatic and fluid sorption. In selecting the nature of the fluid, chemically active or inert, and its physical state, liquid or supercritical, new "materials" can be generated. In addition, the interplay of temperature and pressure allows tailoring the obtained material structure for specific applications. Several complementary techniques have been developed to modify, analyze and characterize such structures: scanning transitiometry,(1) vibrating wire (VW)-PVT coupling,(2) thermoporosimetry, (3) temperature modulated DSC (TMDSC).(4) Selected examples serve to illustrate the great variety of possible applications in materials science. Typically, polymers like polyethylene (PE), poly (polyvinyldiffluoride) PVDF and fluid like, methane, or simple gas (CO_2 or N_2) can produce materials from soft gel to rigid foams.
Absorption of an appropriate fluid in a cross linked polymer leads to a swelling phenomenon. Thermoporosimetry is a calorimetric technique developed to measure the shift by confinement of thermodynamic transition temperatures of the absorbed fluids. Solvents or mercury can be currently used as liquid phases. Application of thermoporosimetry to a swollen cross linked polymer allows to calculate the mesh size distribution and to evaluate the degree of reticulation of the polymer. The same technique can be applied to characterise the pore size distribution in a foamed polymer.

References

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