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MODIFICATION OF POLYMERS BY SUPERCRITICAL GASES

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Polymers are currently processed in many different ways involving elevated temperatures and high pressures as well as chemical agents. In specific applications, tuning of targeted structures (foams) and/or introduction of additives (pigment, drug) such chemical agents are supercritical gases. During these processes, polymers undergo modifications implying particular states under precise thermodynamic conditions. For optimal performances, the corresponding thermophysical properties of polymers must be accurately known. In this respect, of crucial interest is the glass transition region.

We are currently using new techniques like *scanning transitiometry* (SC) (1) to study phase transitions and simultaneously measure the thermomechanical coefficients of the different phases or like *sorption/swelling technique* (SST) (2) to simultaneously measure the solubility of a supercritical gas in a polymer and the accompanying change in volume of the polymer matrix. Such techniques are routinely operated over extended ranges of temperatures and pressures from ambient conditions up to 300°C and 100MPa (200MPa with scanning transitiometry) respectively, which allow to treat a large number of polymeric materials. In addition *modulated temperature differential scanning calorimetry* (TMDSC) (3) is used to investigate the glass transition of modified samples. Ongoing work on polystyrene in interaction with different gases (carbon dioxide, nitrogen) will serve to illustrate the use of the above techniques to accurately monitor polymer modifications. Eventually, *scanning electronic microscopy* (SEM) is used to control the extend of modification.

References:

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