SUPERCRITICAL WATER AND LOWER ALCOHOLS AS SOLVENTS FOR HEAT-RESISTANT POLYMERS

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The interaction of polymers, in particular heat- and thermoresistant polymers, with supercritical solvents such as water and lower alcohols has been investigated. Products (nano/microparticles or liquid solutions) that form at throttling of supercritical solutions have been studied. Polyphenylene sulfide (*PPS*), polypyromellitimide (*PI*), polytetrafluoroethylene (*PTFE*), polycarbonate (*PC*), polysulfone (*PS*), polyetherimide (*PEI*), polyethersulfone (*PES*), polyphenylsulfone (*PPSF*), and polyacetal (*PA*) were chosen as subjects of the study. Experiments were carried out in an autoclave reactor under stirring at temperature 375-380°C and pressure 240-260 atm for the system "polymer – SCW", and at 260-265°C and 100-190 atm for the system "polymer – sc-alcohol". Contact time was ca. 2 h for all the experiments. Then supercritical fluid was throttled to a low-pressure chamber onto specially designed targets. Structure of the products precipitated on the targets after throttling was analyzed by scanning electron microscopy (SEM). In all cases, the formation of solid micro- and nanoparticles of polymer or its destruction products was observed.

The dissolution of PPS, PI, PTFE, PC, PS, PEI, PES, PPSF and PA in supercritical water (SCW) was accompanied by gas emission of different intensity, which indicated a partial destruction of polymer under consideration. However, throttling of supercritical solution into the vessel filled with air in all cases led to the formation of crystalline or spherical nano- and microparticles of SCW dissolved polymer. SEM analysis was used to determine shape and size of the resulting polymer particles and compare the characteristics of nano- and microparticles formed from different polymers and at different conditions.

Contacting of *PS, PEI, PPSF* and *PI* with supercritical isopropyl alcohol led to their complete dissolution. Polymer dissolution was accompanied by a spontaneous increase of pressure, which may be related with partial destruction of the polymer followed by emission of low-molecular gaseous products. Gas emission was most pronounced with polyacetal, whose thermal destruction proceeds by depolymerization mechanism. As a result of such transformations of the listed polymers in sc-propanol, throttling of supercritical solution did not led to the solid phase formation, and products were represented by a homogeneous liquid solution. Chromato-mass spectrometry data are reported for the products of such transformations of the polymers under study.