4TH INTERNATIONAL CONFERENCE ON POLYMER – SOLVENT COMPLEXES AND INTERCALATES

PRAGUE, CZECH REPUBLIC
JULY 22ND - 25TH, 2002

The 4th International Conference on Polymer-Solvent Complexes and Intercalates, which was at the same time the 63rd meeting of Prague Meetings on Macromolecules, was held in Prague on July 22 - 25, 2002; it closed almost three weeks before the terrible flood which hit Prague this summer. The conference, organized by the Institute of Macromolecular Chemistry, Academy of Sciences of the Czech Republic under the auspices of the European Polymer Federation and Czech Chemical Society, was a part of a series following the previous events in Meyrueis (1996), Ischia (1998) and Besancon (2000). The aim of the conference was to bring together scientists involved in the study of polymer - solvent interactions, complexes and intercalates, who use different techniques and approaches. Sixty-four active participants from 17 countries took part in the meeting; of them, the largest number was from the Czech Republic (19), France (12) and Italy (8). They could listen and discuss 10 invited main lectures (50 min, including discussion), 13 oral communications (20 min) and could see and discuss 37 poster communications. Among topics of the conference were polymer-solvent interactions in solutions, gels, solids and interfaces, structure (conformation, morphology, spectroscopy, SANS), phase transitions (phase diagram), rheology (mechanical properties), dynamics (relaxations) and applications of gels, solid materials, biopolymers and liquid crystals. The main lectures, presented by outstanding specialists in the given field (G. ten Brinke, D. Golodnitsky, J.-M. Guenet, M.W. Hosseini, M.J. Miles, A.K. Nandi, C. Rossi, K. Tashiro, A.E. Tonelli, O.N. Tretinnikov), along with short oral communications, offered to the participants a survey of the most up-to-date problems and well-founded new findings and views. Very stimulating discussions took place after each presentation. Many interesting results were presented in two poster sessions. Summaries of all lectures and posters were published in the Programme Booklet; they are still available at http://www.imc.cas.cz/sympo/4icpsci.html. Full texts of a major part of main lectures, oral communications and posters will be published in a special volume of "Macromolecular Symposia" in 2003. Besides the scientific programme, some special events were organized for the participants, such as piano concert at the St. Lawrence Church in Prague and an excursion to Sychrov Castle and Dětenice Chateau in connection with an informal dinner.

As mentioned above, the contributions presented at the conference dealt with various subjects of polymer - solvent interactions, complexes and intercalates as investigated by various methods (DSC, X-ray and neutron diffraction, microscopic methods, infrared and Raman spectroscopy, NMR spectroscopy, mechanical measurements, computational simulations, etc). Because of the scope of this journal, we will mainly focus on the contributions dealing with rheological aspects. We divided these contributions into two groups: those dealing with polymer solutions and gels, and those devoted to concentrated multiphase systems:

1. *Polymer solutions and gels*

During the meeting several contributions were presented which have proved that polymer-solvent complexes affect the rheological behaviour. Just in the introductory lecture "Polymer-solvent complexes and intercalates prepared under various conditions" (J.-M. Guenet) it was shown that cooling down hot, homogeneous solutions of a certain concentration or allowing the solvent to diffuse into polymer matrix at a given temperature to the same concentration yields basically the same thermal and rheological behaviour (an example was shown for isotactic polystyrene). On the other hand, differences were found in mechanical properties for solutions in various solvents (trans-decalin, cis-decalin and 1-chlorodecane).

N. Kutsevol et al. have proved that conformational changes in aqueous solutions of poly(vinyl alcohol)/poly(acrylamide) graft copolymers with various amount of the grafts depend on the amount of grafts. The concentration and temperature dependences of viscosity (as well as the Huggins constant) strongly reflect conformational changes in solutions; these changes on heating and cooling were reversible.

Polycomplexes for regulation of stability of dispersed systems were also investigated (N. Permyakova et al.). Viscometry together with IR spectroscopy and potentiometric titration was used to establish the complex formation in the three-component system poly(styrene-co-maleic acid)-poly(ethylene oxide)-SiO_2 in water as function of molecular weight of poly(ethylene oxide). The results were interpreted by the difference in pair energy interactions.

Several interesting contributions dealing with rheological properties of gels were presented. C. Mijangos et al. has presented results on poly(vinyl alcohol) hydrogels with colloidal dispersion of magnetic particles of size ca 10 nm. These "smart" materials exhibit elastic and swelling properties which are strongly dependent on field strength; in addition to the coupling elasticity, they show an anisotropic character in external magnetic field.

The highly conducting doped polyaniline gels in cresol solutions (of concentrations up to 60 wt%) were studied by dynamic mechanical spectroscopy (M. Vecino et al.). It was found that storage modulus G'_e in rubber region scales with polymer concentration, c, as $G'_e \sim c^2$. The viscoelastic response of the gel vanishes at highest temperatures giving a viscous dominant behaviour.

It was reported (M. Melnik et al.) that xerogels based on poly(acrylamide)/poly(vinyl alcohol) graft copolymers exhibit several relaxation processes which were determined by dielectric spectroscopy. A molecular interpretation of individual transitions was suggested.

Rheological measurements of complex modulus were used to investigate the structure of gelatin gels of mammalian and fish origin (A. Simon et al.). It was found that the storage moduli G' of mammalian gels are higher than those of fish gels, probably due to different contents of helical structures in both systems.

2. *Concentrated multiphase systems*

D. Golodnitsky et al. have shown that the effect of stretching strongly influences the structural organization in polymer electrolytes and leads to enhancement of longitudinal DC conductivity by a factor of 5 - 40 in poly(ethylene oxide)/lithium salt complexes (such as with lihium iodide, lithium trifluoromethanesulfonate, lithium trifluromethanesulfonamide, lithium hexafluoroarsenate and lithium bis(oxalato)borate). The results support the idea of preferential ionic transport along the poly(ethylene oxide) helical axis in crystalline phase.

Mechanical measurements were shown to be powerful in clarification of the structure of new class of composite nanomaterials prepared by encapsulation (S. Poux et al.). The encapsulation was achieved within the fibrils of thermoreversible gels. Two systems were investigated: isotactic polystyrene/Cu(II) 2-ethylhexanoate/trans-decalin and poly(hexyl isocyanate)/Cu(II) 2-ethylhexanoate/octane.

The viscoelastic behaviour of alternating terpolymers of ethene, propene and carbon monoxide exhibits systematic hysteresis effects during initial heating up to 220°C and subsequent cooling down to 120°C (V.P. Privalko et al.). This hysteresis can be regarded as experimental evidence for the existence of ordered nanodomains which served as bridges for the continuous disordered matrix. With the same systems also dielectric spectroscopy was used. Strong asymmetry of dielectric relaxations was regarded as additional evidence for interference of nanodomains with matrix.

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Carbon black (CB) filled poly(ethene-co-ethyl acrylate) and poly(dodecanolactame-block-butene-1,4-diol) were investigated as conductive composites (J.F. Feller et al.) by rheological and electrical measurements. A strong reinforcing effect of CB in both the solid and molten materials was observed; the effect was analyzed in terms of interactions and mobility of the chains and CB as function of the CB content and temperature. Rheological properties, especially during the processing, control the electrical behaviour and reproducibility. The effect of shear rate and temperature on CB distribution in poly(butylene terephthalate)/poly(ethene-co-ethyl acrylate) blends was also investigated. The effect of an increasing blending temperature favours particle agglomeration in the melt and decreases the resistivity.

Y. Grohens et al. have contributed to better understanding of the thickness dependence of glass transition. They found that fast solvent evaporation from poly(methyl methacrylate) films results in chain conformations which can be depicted as a gel-like structure; this leads to a less entangled state which is frozen-in and causes a Tg dependence on thickness of the film.

At the end of the successful conference in Prague it has been announced that the next (5th) International Conference on Polymer-Solvent Complexes and Intercalates will be held in July 2004 in Lorient (France).

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