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Editorial

Foreword to special section of polymer containing collected papers from the IUPAC World Polymer Congress, Macro 2004, Paris, July 4–9th, 2004. Symposium on 'polymer blends, composites and hybrid polymeric materials'

The 20 papers included in this special section were based on presentations at the cited symposium, which consisted of 36 presentations grouped into specified categories. These papers amply show the wide range of topics covered in the symposium, and demonstrate the interest and importance of these exciting areas of polymer science and engineering.

From this selection of papers, it appears clearly that materials strategies aim at reducing the dimensions of the components of polymer-based multiphasic materials. Most of the presentations and most of the papers of this special section were related to organic, inorganic or porous nanostructures which were obtained in a thermosetting, amorphous or semi-crystalline thermoplastic polymer matrix.

When the mixture is based on two polymers, a serious obstacle for achieving an ideal nanostructured material is the fact that most polymers are immiscible due to the unfavourable entropy of mixing. Introducing attractive forces between the components is one way of preventing macrophase separation. Another way is found the in situ compatibilization by coupling reactions. In some case bicontinuous and/or nanostructures blends are expected.

Similar difficulties arise when the second component is constituted of inorganic particles (metals or metal-oxides like silica particles, clays, etc). To prepare such nanocomposites with randomly dispersed particles, solvent-free methods based on the mixing of the polymer and pure isolated colloids are not usually successful because the related particles form strongly connected aggregates. Similarly to polymer blends, thermodynamic compatibilization by attractive forces (hydrogen-bonding, charge-transfer complexes, ionic interactions) between the mixture components, in situ compatibilization by coupling reactions, and in situ synthesis of one or both components are different ways of achieving the goals.

These new materials with coupled/interpenetrated chemistries, structured on nanometer scales can be thermodynamically stable. When the dimension of one of the components is reduced from micro to nanometer scale, the surface to volume ratio is increased resulting in new and unexpected properties. New molecular composites or new microcellular foams have been obtained. New optoelectronic properties are expected from large microdomains alignment in polymer-based multiphasic materials. Nanostructured blends which can exhibit unique properties like improved barrier properties, superior mechanical performance, and including transparency, are other examples of new materials.

It is hoped that readers will not only find this section useful in getting up to date on these topics, but will also be inspired to initiate their own projects in response to some of the challenging issues raised in these papers.

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