The problem of the compatibility in polymer blends has long been a subject of interest for both theorists and experimentalists. Unlike homopolymers the blends comprising random copolymers often show “windows” of miscibility on their phase diagram even in the absence of specific interaction between monomer units. Such “windows” were observed in systems where mutual repulsion between dissimilar units in the copolymer macromolecule would suffice to overcome the repulsion between them and units in other components of the blend in hand. This “repulsion effect” is conveniently elucidated in terms of a simple Flory-Huggins type Theory enabling one to predict the location of the boundaries of miscibility regions for an arbitrary polymer blend with known values of the degree of polymerization of the components and parameters $\chi_{\alpha\beta}$ of interaction between all pairs M_α and M_β of their monomer units. Such attractive theoretical approach, in view of its simplicity, proves to be particularly advantageous when treating experimental data on the investigation of the phase states of polymer blends and especially for the search of new advanced materials on their basis.

Typical problem arising for thermodynamic examination of blends involving copolymers consists in determining under given temperature those regions of values of their composition, at which the system remains homophase. The size and shape of such miscibility regions of particular polymer specimen have been suggested to term “miscibility maps” (MM). An exhaustive classification was put forward of all topologically conceivable kinds of such MMs depending on the Flory-Huggins parameters for a mixture of two binary statistical copolymers having a common monomer unit. Later the principles were formulated of such a classification for arbitrary blends consisting of any number of components, each comprising any kinds of units. In the mathematical model underlaying this version of the “Miscibility Maps” software the consideration was restricted for simplicity sake to the case of rather high-molecular polymers where the dependence of the MM shape on their molecular weight may be neglected. Such an approximation is widely used to estimate the compatibility regions of real polymer blends. It corresponds to ignoring the combinatorial entropy contribution to the free energy of mixing that for such blends is normally small as compared to the enthalpy contribution. This simple approach has an indisputable advantage when establishing the correlation between the topology of the boundary, which separates the regions of compatibility and incompatibility of the blend. Within the framework of such an approximation it is sufficient to have an information only on the values of the Flory-Huggins parameters $\chi_{\alpha\beta}$ for all pairs M_α and M_β

of monomer units of polymer blend under examination. To each given set of these parameters there corresponds the particular MM in the space of compositions of blend components. Once the MM has been obtained, one can predict theoretically the limits of the variation of these compositions where the appearance of "miscibility windows" can be expected in the blends comprising statistical copolymers.

Our software product permits a user to construct the MM of systems of different types, proceeding from given values of the Flory-Huggins parameters. Hence this product offers a possibility not only to reveal the topology of the MM of a polymer blend, containing copolymers prepared by a polymerization of given monomers but also to determine quantitatively the boundaries of compatibility regions of any blend depending on composition of the copolymers involved.

The program has highly intuitive user-friendly interface. To try the "Miscibility Maps" download the self-extracting archive, unzip it and run mmdemo.exe. To get an idea of the potentialities of the program load one of the predefined base variants (by selecting **Set Base Variant** option in the **File** menu) and perform calculations by clicking on the **Compute!** menu. Special terms encountered in the program should be readily familiar to those dealing with the miscibility of copolymer blends.

If you want to get any additional information on the "Miscibility Maps" or any other software products developed by us you may contact Semion Kuchanov at kuchanov@orc.ru.