Chemistry of non-aqueous solutions and melts (KDIT66)
thematics

Lecturer: Prof. Dr. Pál Sipos (sipos@chem.u-szeged.hu)

1. Application of non-aqueous solutions – necessity, risks, alternatives. Relevance of the various physical properties. Acidity and basicity of solvents. Donor- and acceptor numbers. Donicity scales: crystal field splitting and the Guttmann's donor number. Acceptor numbers according to Kosower, Diemroth-Reichardt and Guttmann. Classification of the solvents according to Kolthoff. Solvation of ions in non-aqueous solvents. Solvation energy. Heat of dissolution, solubility. Solvation of ions, ion-solvent interactions, their effect on the solubility. The structure of the solvated ions, primary and secondary solvation shell. Methods for determining solvation number. The effect of the solvent on the stability of complex compounds.

2. The association of ions according to Bjerrum-Fouss. Ion-pairing, types of ion pairs: contact, solvent shared and solvent separated ion pairs. Acid-base reactions in non-aqueous solvents. pH-scales in various solvents, comparison of pHs, the transfer activity coefficient. Acid-base titrations in non-aqueous solutions. Supercritical fluids. Ionic liquids.

3. Extremely concentrated aqueous solutions. Comparison of dilute and concentrated solutions. Full hydration barrier. Density and viscosity of concentrated electrolytes, experimental determination and theoretical approximations. Experimental means to study concentrated electrolytes. Structural and thermodynamic characterization of concentrated electrolyte solutions: theoretical and practical limitations. Use of H2/Pt and Na/Hg electrode, UV-Vis spectrophotometry and Raman spectroscopy for the characterization of equilibria in concentrated electrolyte solutions. The ionic strength dependence of the equilibrium constants: the ionic product of water in hypersaline solutions. Application of concentrated electrolytes in the analytical chemistry.