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## A new Data Handling of the IR Spectra of Electrolytic Solutions and Similarities with Thermonuclear Plasmas

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Classical theories of electrolytes are based on the picture of a fully ionised gas [1] because it is assumed that, during the solution, salts are completely dissociated in ions. This makes the theoretical problem of the electrolytic solutions equivalent to the problem of a fully ionised gas.

We studied the water molecule organization in chlorides salts by using the methods of the classical Infra-Red spectroscopy [2]. The existence of an isosbestic point (i.e. equal absorption point) allows us to perform an innovative analysis on the long-range restructuring of water on increasing concentration of the solute. Isosbestic points are commonly met when spectra are taken on a system where a transformation is in progress upon changing a parameter and represents the equilibrium point between two populations of molecules differing from their degree of reciprocal correlation. We defined a deformation parameter which shows that the spatial organization of the solution occurs in three different phases depending on the solute density: a low concentration phase, where the solutes are accommodated without important distortion of the pure water matrix; an intermediate phase showing a cooperative behavior among molecules; and a third, where the deformation reaches its maximum value because any further increase of the ions in solution is prevented by the recombination.

A simple mathematical treatment of the data shows the emergence of a self-similar behaviour in concentrated solutions of strong electrolytes. Actually, a log-log linearity is observed showing that the deformation of the OH vibration band increases by the same amount per unit of solute, freely both from the total quantity of ions present in the solution and from the ion type. In other words, beyond certain concentrations (whose exact value depends on the ion nature), the restructuring of the water-water interactions shows similar patterns at increasingly changing scales. This observation implies a collective property of a system and cannot be anyhow related to the behaviour of independent molecules.

We propose that a similar model can be applied to thermonuclear plasma after a suitable choice of the deformation parameter. It can be expected that, beyond a certain density limit, collective (and possibly coherent) behaviour of the plasma have to be taken into account and that the plasma-wall interactions can be correctly described only keeping into account the collective behaviours.

1) P. Debye, E. Hückel, Z. Physik, 25 (1924) 97.

2) A. De Ninno, M. De Francesco, Chem. Phys. Lett. 705, 2018, 7-11.

### Summary

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