Charge properties and size of small colloids by electroacoustics: a benchmark system for calibration

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An extensive use of colloids in numerous industrial applications requires a robust characterization of the properties of these systems. A key aspect of colloidal particles is that most of them bear an electrical charge that controls their interactions with the surrounding medium. Hence, the understanding of the properties characterizing this charge is of prime importance. There are a number of techniques used to determine "effective charge" of the colloids. Among them are dynamic methodologies, such as electroacoustic, dynamic conductivity and dynamical light scattering. The former consists in applying an ultrasonic wave to an electrolyte solution and measuring the induced electric field or the inverse, depending on the device. This technique is much less developed than the others despite its advantages: non dilute and non-transparent colloidal systems can be studied, and there is no size limit for the objects. However, the solid theory that would describe extensively nano-sized objects dispersions such as small colloids is still missing. To address this issue, a proper benchmark system is required.

Polyoxometalates (POMs) were already chosen as calibrants for the electroacoustic measurements [1] due to their high electron density and so a good acoustic contrast as well as high polarizability. In a recent work on POMs [2] we demonstrated that these macroions being highly polarizable have the propensity to adsorb on hydrophilic and neutral surfaces. Thus, micelles made of non-ionic surfactant with ethoxy or sugar polar heads in presence of POM in solution constitute the nano-sized charged colloids with tunable properties, for example as a function of their core-swelling. In order to apply this system for electroacoustic calibration, the comprehensive characterization of the micellar aggregates is required. The special interest has the equilibrium, POM in solution and POM adsorbed onto the micelles. Using techniques such as NMR, SAXS, DLS the complementary analysis was performed. We demonstrate that this system can be used as a benchmark system in electroacoustic and for the help in development of the above mentioned theory.

[1] R.W. O'Brien, D.W. Cannon and W.N. Rowlands, *J. Coll. Inter. Sci.*, 1995, **173**, 406.
[2] B. Naskar, O. Diat, V. Nardello-Rataj and P. Bauduin, *J. Phys. Chem. C*, 2015, **119**, 20985.