

Broadband Dielectric Spectroscopy in Nano-(Bio)- Physics

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Abstract

Broadband Dielectric Spectroscopy as one of the major tools in molecular physics benefits from the extraordinary advantage that its sensitivity increases with decreasing thickness of a sample capacitor and hence with a decreasing amount of sample material. This enables one for instance to carry out spectroscopic measurements on *quasi-isolated* polymer coils in nano-structured capacitor arrangements, having thicknesses as small as 10 nm. It is demonstrated that for polymers like polyvinyl pyridin (P2VP) or polyvinylacetate (PVAC) the dynamic glass transition can be measured for (averaged) sample thickness as small as ~ 2 nm in a wide spectral range (10^{-2} Hz – 10^6 Hz) and at temperatures between 150 K to 350 K. *No* shift of the mean relaxation rate and *no* broadening of the relaxation time distribution function are found compared to the bulk liquid.

Electrode polarization is an ubiquitous phenomena taking place at the interface between a metal and an ionic conductor. A *quantitative* theory will be presented, which enables one to deduce from its characteristic frequency, temperature and concentration dependencies – by use of a novel formula – the *bulk* conductivity of the polyelectrolyte under study. It is shown that the electrical relaxation processes take place within a *nanometric* layer at the (ionic conductor/metal) interface which can be analysed in detail.