Broadband Dielectric Spectroscopy and its Application to dynamic Glass Transition: From the bulk to the confined State

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The theoretical basics of broadband dielectric spectroscopy, the equipment to measure the dielectric properties in a frequency range form 10^{-5} Hz to 10^{10} Hz and the methods to analyze dielectric spectra are briefly introduced.

After that introduction broadband dielectric spectroscopy is applied to reveal the nature of glassy dynamics with an immediate problem of soft matter physics. Near the glass transition temperature T_g a dramatic increase of the characteristic relaxation times τ or the viscosity over more than 14 orders of magnitude is observed by decreasing temperature by a factor of 2. This can be most naturally interpreted as resulting from a cooperative behavior. The temperature dependencies of the dielectric relaxation time, the dielectric strength and the shape of the dielectric relaxation function are analyzed in detail and discussed in the frame of different theoretical approaches.

To prove if a inherent length scale is relevant for glassy dynamics dielectric investigations of polymers confined to nano-porous glasses are presented. In this case the results are compared to high frequency scattering techniques like neutron scattering.