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Application of new treatment methods for "reading" of the complex capacitance: A quantitative description of the aging phenomenon in polymer glasses

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ABSTRACT

The glassy dynamics have been investigated using electric capacitance measurements for thin films of poly(2-chlorostyrene). The observed relaxation behavior of the electric capacitance has been analyzed using a new smoothing procedure for the noisy curves and the eigen-coordinates method for the fitting trends obtained in the results of the smoothing procedure. Such analysis has given us a fascinating relaxation function related to the glassy dynamics. New aging curve will give us a chance to understand a proper physical mechanism (related to a possible formation of dynamical self-similar interacting clusters) that can describe this interesting phenomenon. Physical consequences for the recognized relaxation function are discussed.

1. Introduction and formulation of the problem

A very slow relaxation process toward equilibrium state is often observed below the glass transition temperature T_g in many glassy materials [1,2]. This slow relaxation process is well-known as *aging* phenomenon and it is regarded as an important common property characteristic of disordered materials such as spin glasses [3–6], supercooled liquids [7], relaxor ferroelectrics [8], and polymer glasses [9–11]. The characteristic behavior of aging dynamics below T_g is closely related to the nature of the glass transition. Therefore, it is expected that the elucidation of aging phenomena can lead to full understanding of the mechanism of the glass transition in disordered materials, which still remains as a controversial topics [12].

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