Visual Study of Timeline and Collaborative Events of Ion Trajectories in Glass Structure

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ABSTRACT

Our perception of the ion trajectories has largely relied on numerical and statistical analysis of data from experimental dimension and computer simulation results (Funke, 1993; Ngai, 1993; Smith et al., 1995; Ngai et al., 1998; Ngai et al., 2002). In particular, we considered a simulated 3D time-varying model of ion trajectory and examined the temporal correlation among chaotic movement of the ions. Our goal is to contrive effective visual study to assist scientists, especially physicists, in ascertaining temporal correlation among intricate and apparently chaotic time-varying datasets. We proposed a hybrid application with combination of iconic techniques, global and local colour scale and opacity scheme for spatio-temporal depiction. We illustrated also few images that can offer an effective tool for visually mining 3D time-varying scientific datasets.

Key words: System application, Spatio-temporal visualisation, Coding theory, Colour scale, Time-varying datasets, Molecular dynamics, Iconic representation

INTRODUCTION

The transport of ions within aperiodic glass structures has remained an enigma for many years, the resolution of which will be critical for explaining the huge versatility of glass in technology, including its homogeneity and its electrical, mechanical and chemical characteristics. Physicists have proposed a variety of ionic conduction models, ranging from the correlated forward and backward hopping of single cations (Funke, 1993), to collaborative process involving the transport of many mobile cations (Ngai, 1993; Smith et al., 1995; Ngai et al., 1998).

Experimentally, the collaborative character of ion trajectories in glasses can be inferred from dielectric and ion transport properties. The existence of such collaborative phenomena was suggested by examining ionic conductivity data, tracer diffusion measurements and dielectric data collected from experiments (Greaves and Ngai, 1995; Ngai et al., 1998; Ngai et al., 2002). However, experimental data which measure macroscopic properties and lack in structural periodicity do not provide any description of the atomic structure and trajectories. Any detailed observation of