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Investigating Structural Relaxations in DGEBA - A Unification of Microscopic and Macroscopic Methods

DGEBA is used in many dielectric systems. Understanding factors that influence its performance and longevity require a knowledge of charge dynamics, which intrinsically are linked to the molecular structure and dynamics. Bulk techniques have been used to determine structural relaxations and activation energies; however, these methods only provide information on processes, not on the causal underlying molecular dynamics. Our aim is to unify these bulk measurements with information at the molecular level provided by μSR.
We have studied the alpha relaxation of DGEBA to determine the glass transition temperature, Tg, and activation energy, Ea using μSR. Radicals formed have been characterised (with DFT and ALC), with Mu adding to Phenyl rings in the molecules'main chain. Measurements were made as a function of temperature and field, with data fitted to obtain T1avg , with Tg and Ea determined from Arrhenius plots as described by McKenzie [1].
Our value for Tg (348K at 200G) agrees well with DSC measurements (358K), while our value for Ea is smaller than that given by dielectric spectroscopy, perhaps due to muons being uniquely sensitive to phenyl ring motion, whereas bulk measurements contain dynamic information from the whole molecule.
The contribution will discuss muon sites and dynamics, the likely influence on relaxation parameters, and the correspondence between the micro and macroscopic measurements.

[1] McKenzie et al, J. Phys.: Condens. Matter 33 (2021) 065102

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