Properties and Analysis of Thermally Aged Poly(ethylene oxide)

M. Reading[*] and A. S. Vaughan

University of Southampton, UK

*E-mail: mdr@ecs.soton.ac.uk

Recent studies have been performed into the use of polyethylene oxide (PEO) as a model system for observing the fundamental effects of adding micro and nano sized fillers to create polymeric composite systems. Many factors contribute to the successful creation of such a composite system, including dispersion of the filler and treatment of the material during creation. For example, while producing thin films of the materials for testing, high temperatures were used for short periods of time in open air to press the samples into small discs. It is well known that prolonged high temperature exposure can alter the chemistry and structure of polymeric materials and that small variations in the original chemistry, such as longer molecular weights or introduction of fillers, can reduce or possibly accelerate this 'ageing' effect. From these previous investigations many property changes were observed during addition of filler or variation of molecular weight, therefore to accurately attribute these changes to a cause the thermal ageing of the material should be observed.

This investigation looks at the same 3 molecular weight PEO systems as those used in the previous investigations and analyses them for their vulnerability to thermal ageing. One thermally aged sample is then taken and tested alongside an unaged sample to observe the effects that the process has on the properties. This includes rheology in solution, differential scanning calorimetry (DSC), AC electrical breakdown, dielectric spectroscopy and fourier transform infra-red (FTIR). By observing the property changes of aged samples it is possible to better understand the thermal ageing process occurring and possibly a way to reduce the effect, along with considering the effect with regard to the behaviour of the previously tested composite samples.
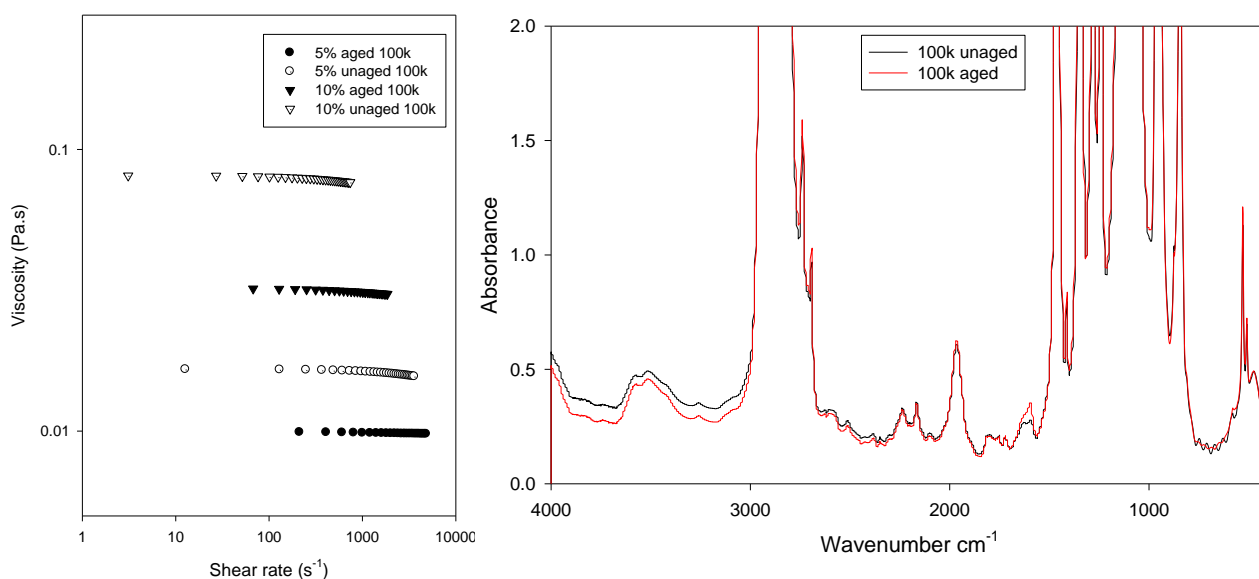

Figure 1: Viscosity of plots of aged and unaged samples (left)
and FTIR spectra of aged and unaged samples (right)