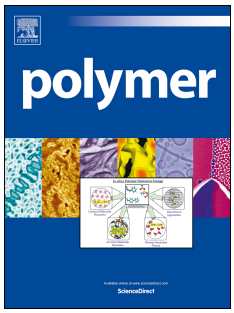
Accepted Manuscript



Examining the nature of the network formation during epoxy polymerization initiated using ionic liquids

Fiona C. Binks, Gabriel Cavalli, Michael Henningsen, Brendan J. Howlin, Ian Hamerton

PII: S0032-3861(18)30648-7

DOI: 10.1016/j.polymer.2018.07.046

Reference: JPOL 20765

To appear in: *Polymer*

Received Date: 7 June 2018

Revised Date: 13 July 2018

Accepted Date: 14 July 2018

Please cite this article as: Fiona C. Binks, Gabriel Cavalli, Michael Henningsen, Brendan J. Howlin, Ian Hamerton, Examining the nature of the network formation during epoxy polymerization initiated using ionic liquids, *Polymer* (2018), doi: 10.1016/j.polymer.2018.07.046

Examining the nature of the network formation during epoxy polymerization initiated using ionic liquids

Fiona C. Binks[1,†], Gabriel Cavalli[1,‡], Michael Henningsen[2], Brendan J. Howlin[1], Ian Hamerton[3,*]

[1] Department of Chemistry, Faculty of Engineering and Physical Sciences, University of Surrey, Guildford, Surrey, GU2 7XH, U.K.

[2] Intermediates Division, BASF AG, Carl-Bosch-Straße 38, 67056 Ludwigshafen, Germany.

[3] Bristol Composites Institute (ACCIS), Department of Aerospace Engineering, School of Civil, Aerospace, and Mechanical Engineering, Queen's Building, University Walk, University of Bristol, Bristol, BS8 1TR, U.K.

[†] Present address: Hexcel Composites, Duxford, Cambridge, CB22 4QD, U.K.

[‡] Present address: School of Engineering and Materials Science, Queen Mary University of London, 327 Mile End Road, London, E1 4NS, U.K.

[*] *Correspondence to Dr Ian Hamerton, E-mail: ian.hamerton@bristol.ac.uk*

ABSTRACT: A commercial diglycidyl ether of bisphenol A monomer (Baxxores^{TM} ER 2200, eew 182 g/mole) is thermally polymerized in the presence of an ionic liquid, 1-ethyl-3-methylimidazolium acetate at a variety of loadings (5-45 wt %). The loss modulus data for cured samples containing 5 wt % initiator display at least two thermal transitions and the highest storage modulus occurs in the sample that has been cured for the shortest time at the lowest temperature. Samples that are exposed to higher temperatures (140, 150 °C) yield more heterogenous networks, whereas following exposure to a much shorter/lower temperature cure schedule (80 °C) exhibits a considerably higher damping ability than the other samples, coupled with a lower glass transition temperature. Differential scanning calorimetry reveals that the latter sample achieves a conversion of 95 %, while crosslink densities for the DGEBA samples containing 5 wt % and 15 wt % are respectively 9.5 x 10^{-3} mol. dm^{-3} and 1.2 x 10^{-3} mol. dm^{-3} (when cured to 80 °C) and 2.0 x 10^{-2} mol. dm^{-3} and 2.4 x 10^{-3} mol. dm^{-3} (when cured to 140 °C).

Keywords: Epoxy Resins, Ionic Liquids, Initiators, Network formation, Physico-mechanical Properties.