

Structural and Thermal study of a bio-based unsaturated polyester resin: Two-step vs one-step polymerization procedures

Dimitra PATSIAOURA¹, Lazaros PAPADOPOULOS², Dimitrios KARFARIDIS¹, Charles MARKESSINI³, Electra PAPADOPOULOU³, Dimitrios BIKIARIS², Georgios VOURLIAS¹, Konstantinos CHRISSAFIS¹

¹Solid State Physics Section, Physics Department, Aristotle University of Thessaloniki, GR-54124, Thessaloniki, Greece

²Laboratory of Polymer Chemistry and Technology, Department of Chemistry, Aristotle University of Thessaloniki, GR-54124, Thessaloniki, Greece

³CHIMAR HELLAS SA, 15 km National road Thessaloniki – Polygyros, GR-57001, Thermi, Thessaloniki, Greece

Unsaturated polyester resins (UPRs) consist a significant category of thermoset polymers in industry, due to their easy processability, their low cost, their high chemical resistance and foremost their exceptional mechanical properties, leading to their extensive utilization in different industrial sectors such as in the automotive, marine, aerospace and construction industries [1-2]. However, both the growing public awareness related to environmental issues and the demand of sustainable alternatives to fossil based monomers, have led to the need of introducing bio-based UPRs.

In this study, bio-based UPRs were synthesized based on succinic acid, ethylene glycol and maleic anhydride. The synthesis was conducted both via two-step and one-step polymerization. The structure of the materials was studied by means of Fourier-transform infrared spectroscopy (FTIR), nuclear magnetic resonance spectroscopy (¹H NMR) and X-ray photoelectron spectroscopy (XPS). Furthermore, thermal properties of the obtained materials were studied by means of differential scanning calorimetry (DSC) and thermogravimetric analysis (TGA).

The materials which were synthesized by the two-step polymerization procedure were not miscible with the reactive diluent. On the contrary, the materials which were synthesized by the one-step polymerization procedure were miscible with the reactive diluent and they were successfully cross-linked.

Acknowledgments

This research has been co-financed by the European Union and Greek national funds through the Operational Program Competitiveness, Entrepreneurship and Innovation, under the call RESEARCH – CREATE – INNOVATE (project code:T1EDK-01413).

[1] J. Fink, “Reactive polymers fundamentals and applications”, William Andrew Publishing, (2013) 1-48

[2] C. Costa, A. Fonseca, J. Moniz, M. Godinho, J. Coelho, A. Serra, Express Polym Lett, 11 (2017) 885

1) Poster presentation

2) Oral presentation

3) Poster or Oral presentation