Enhancement of Mechanical Properties and Thermal of Poly (Lactic Acid)/ Poly (Ethylene-Co-Glycidyle Methacrylate) / Hexagonal Boron Nitride Blend-Composites through Electron-Beam Irradiation

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Abstract

The main objective of this work is to determine the influence of electron beam irradiation on thermal and mechanical properties of most promising bio-based and biodegradable Poly (lactic acid) (PLA) based blend-composites. The PLA/PEGM blend is prepared, to reduce the brittleness and improve the toughness of PLA, by using twin-screw Micro compounder. However, the heat deflection temperature (HDT) and other tensile properties were reduced. The HBN has been incorporated as part per hundred i.e. 5 phr and 10phr to improve the HDT of prepared blend. The prepared specimens of blend and blend-composites were irradiated to high energy (4.5 MeV) electron beam (E-beam) at different radiation doses to introduce the cross linking among the polymer chains and uniform dispersion of HBN particles in the PLA/PEGM/HBN blend-composites. The further improvements in the notched impact strength and HDT have been achieved in the case of PLA/PEGM/HBN blend-composites. The irradiated PLA/PEGM/HBN 5phr blend composite shows high notched impact strength and HDT as compared to other Unirradiated and E-beam irradiated blend and blend-composites. The improvements in the yield strength and tensile modulus have also been noticed in case of E-beam irradiated PLA/PEGM/HBN blend-composites as compared to Unirradiated blend-composites.

Recent Publications

1. J. -B. Zeng, K.-A. Li, A.-K. Du (2015) Compatibilization strategies in poly (lactic acid)-based blends. RSC Advances **5:** 32546–32565.

2. Kumar, A., Rao, T. V., Chowdhury, S. R., & Ramana Reddy, S. V. S. (2017) Compatibility confirmation and refinement of thermal and mechanical properties of poly (lactic acid)/poly (ethylene-co-glycidyl methacrylate) blend reinforced by hexagonal boron nitride. Reactive and Functional Polymers **117**: 1-9

3. Kumar, A., Rao, T. V., Chowdhury, S. R., & Reddy, S. V. S. R. (2017, June) Effect of electron beam irradiation on thermal and mechanical properties of poly (lactic acid)/poly (ethylene-co-glycidyl methacrylate) blend. In *AIP Conference Proceedings* **1849, No. 1, p. 020039**

4. M.L. Cairns, G.R. Dickson, J.F. Orr, D. Farrar, K. Hawkins, F.J. Buchanan (2011) Electron-beam treatment of poly(lactic acid) to control degradation profiles. Polymer degradation and stability **96**: 76–83.

5. P. Rytlewski, R. Malinowski, K. Moraczewski, M. Zenkiewicz (2010) Influence of some crosslinking agents on thermal and mechanical properties of electron beam irradiated polylactide. Radiation Physics and Chemistry **79**: 1052–1057.

6. B.Y. Shin, D.H. Han (2013) Compatibilization of immiscible poly (lactic acid)/poly (ε-caprolactone) blend through electron-beam irradiation with the addition of a compatibilizing agent. Radiation Physics and Chemistry **83:** 98–104.

7. B.Y. Shin, D.H. Han, R. Narayan (2010) Rheological and Thermal Properties of the PLA Modified by Electron Beam Irradiation in the Presence of Functional Monomer, Journal of Polymers and Environment **18:** 558–566.



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