Sustainable Thermoplastics from Renewable Resources: Thermal behavior of Poly(1,4-cyclohexane dimethylene 2,5-furandicarboxylate)

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Abstract

Poly(1,4-cyclohexane dimethylene 2,5-furandicarboxylate) (PCHDMF) is a sustainable thermoplastic that can be prepared from renewable resources with potential uses as a replacement for its terephthalate (PCHDMT) and naphthalate (PCHDMN) homologues. A detailed study was undertaken to assess its thermal behavior and chemical/structural characteristics, in comparison to its counterparts. The melting temperature of PCHDMF was observed at T_m=264.5^{o}C, the glass transition was obtained at 77^{o}C and the cold crystallization temperature was seen at 121^{o}C. The melting of the polymers was studied under a variety of conditions and all samples displayed the characteristic melting-recrystallization-remelting behavior. Isothermal and dynamic crystallization tests revealed that PCHDMF crystallizes at faster rates than its homologues, while the equilibrium melting point of PCHDMF was established at 300 ^{o}C. The enthalpy of fusion values for the polyesters were found ΔH_m=137 J/g for PCHDMF, ΔH_m=108 J/g for PCHDMT, ΔH_m=119 J/g for PCHDMN. Using the Lauritzen-Hoffman analysis of spherulite growth rates, larger K_g values were found for PCHDMF, due to its less flexible structure.

References

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