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Room temperature flexible isocyanate-free polyurethane foams

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ABSTRACT

We report the synthesis of sustainable isocyanate-free polyurethane foams. For the first time, polyhydroxyurethane (PHU) foams were synthesized at room temperature by high conversion step growth polymerization of cyclic carbonates and diamines. Trimethylolpropane tris-carbonate and polypropylene oxide bis-carbonate were copolymerized with EDR148 diamine with thiourea as catalyst. A poly(methylhydrogenosiloxane) was used as blowing agent to foam the NIPU by reaction with diamines. NIPU foams were characterized by scanning electron microscopy and by measurement of their swelling index and apparent density. The mechanical compression and the recovery of these NIPU foams were analyzed by dynamic mechanical analyses at room temperature. The thermal insulating capacities and thermal degradation mechanism were determined.

KEYWORDS: Foam; non isocyanate polyurethane; cyclic carbonate; scanning electron microscopy; thermal conductivity; thermal diffusivity

ABBREVIATIONS

AHEW: Amine Hydrogen Equivalent Weight; **CEW:** Carbonate Equivalent Weight; **CDCl₃:** Deuterated Chloroform; **DMA:** Dynamic Mechanical Analysis; **DMF:** Dimethylformamide; **DMSO-d₆:** Deuterated Dimethylsulfoxide; **DSC:** Differential Scanning Calorimetry; **FTIR:** Fourier transform infrared spectroscopy; **GC:** Gel Content; **NMR:** Nuclear Magnetic Resonance; **PPOBC:** Poly(propylene Oxide) Bis Carbonate; **PPO-DGE:** Poly(propylene Oxide) Diglycidyl Ether; **SEM:** Scanning Microscopy Electron; **SI:** Swelling Index; **TGA:** ThermoGravimetric Analysis; **TGA/IR:** ThermoGravimetric Analysis coupled Infrared Spectroscopy; **TGA/MS:** ThermoGravimetric Analysis coupled Mass Spectrometry; **THF:** Tetrahydrofuran; **TMPTC:** Trimethylolpropane Tris Carbonate; **TMP-TGE:** Trimethylolpropane Triglycidyl Ether.

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