



Poly (Hydroxyl Urethane) Adhesives and Binders from CO₂-Based Intermediates

Opportunity

Research is currently inactive on the patent-pending technology "Poly (Hydroxyl Urethane) Compositions and Methods of Making and Using the Same." The technology is available for licensing and/or further collaborative research from the U.S. Department of Energy's National Energy Technology Laboratory.

Overview

Polyurethane compounds are useful in many commercial applications, including high-performance adhesives, surface coatings, sealants, binders, hydrogels, and resins. A polyurethane compound is any polymer composed of a chain of organic units joined by carbamate (—NCOO—) links. Polyurethanes are conventionally formed by the reaction of a diisocyanate and polyfunctional compounds in the presence of a catalyst. A major disadvantage of this synthesis method is the use of monomers containing toxic isocyanate groups. Recent emphasis has been placed on producing polyurethanes without the use of isocyanate through the reaction of a diamine and a molecule having one or more cyclic carbonate functional groups. Compounds resulting from this synthetic route are referred to as poly (hydroxyl urethanes) (PHUs) due to the presence of primary and/or secondary hydroxyl functional groups.

The current technology provides a single-step method for the synthesis of crossed-linked PHUs from CO₂-based intermediates. Crossed-linked compositions are obtained through the use of cyclic carbonate chemistry involving the reaction of a CO₂-derived cyclic carbonate, a thiol, and a compound having two or more amine functional groups. The synthetic process is efficient, simple, flexible, and scalable allowing for the production of less toxic, non-isocyanate containing PHU composites having adhesive properties.

Patent Details

U.S. non-provisional patent application titled "Poly (Hydroxyl Urethane) Compositions and Methods of Making and Using the Same" was filed on 11/7/11. Additional information about this technology is available in the article "Tunable Poly (Hydroxyl Urethane) From CO₂-Based Intermediates Using Thiol-ene Chemistry" in the *Journal of Polymer Science Part A: Polymer Chemistry* 2011, 49(9):2024-2032.

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Significance

- Method utilizes inexpensive CO₂ as a starting material
- Synthesis produces environmentally friendly PHU compositions
- Single step process allows for cross-linked PHU synthesis without the use of solvents
- Scalable, high yield manufacturing process
- Composites can be cured either thermally or with light

Applications

- High performance polyurethane-based adhesives, surface coatings, sealants, binders, hydrogels, and resins

Contact

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