

07 Cyclocarbonates

Introduction

SPECIFIC POLYMERS dedicates important research efforts toward innovative cyclocarbonate functional building blocks for the synthesis of Non-isocyanate PolyUrethane (NiPU) polymers or thermoset material that can substitute Polyurethane (PU) counterparts in various field of applications.

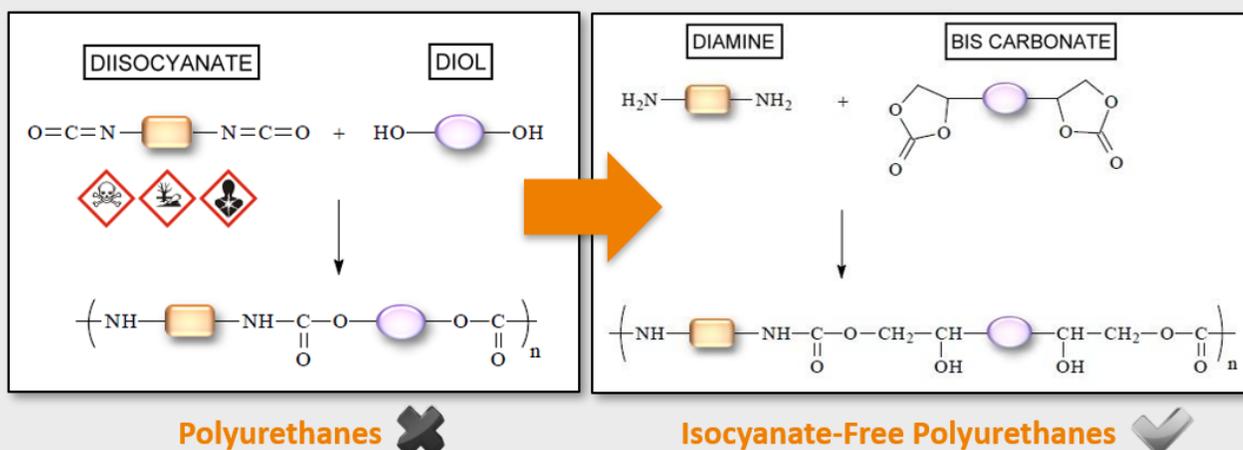
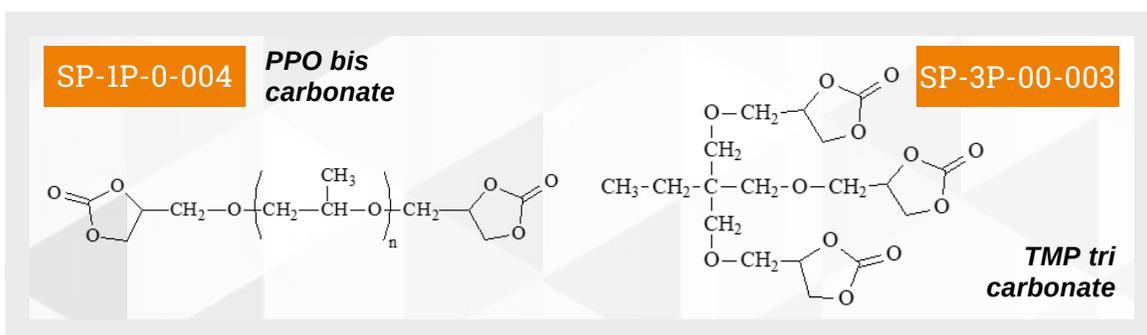


Figure 1:
Cyclocarbonate building-blocks to substitute isocyanate based PU materials by non-isocyanate polyurethanes (NiPU)

Isocyanate-free PolyUrethane

Isocyanate-free polyurethanes are obtained by reaction of cyclocarbonates with amines and are way less toxic than classical polyurethanes prepared from alcohols and isocyanates.[1-3] Those particular polymers materials has been widely studied and found applications in a versatility of fields such as batteries electrolytes, enzyme immobilization, adhesives or photopolymerizable coatings.[4] Besides, poly(hydroxyurethane)s appears as an innovative and promising alternative to classical PU for tomorrow's materials.

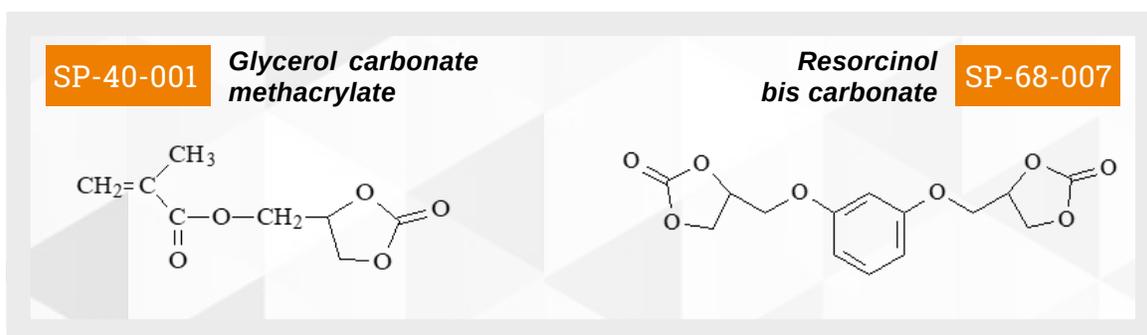


[1] 1.Besse, V., R. Auvergne, et al. (2013). *Reactive & Functional Polymers* 73(3): 588-594.

[2] 1.Besse, V., G. Foyer, et al. (2013). *Journal of Polymer Science Part a-Polymer Chemistry* 51(15): 3284-3296.

[3] 1.Guan, J., Y. H. Song, et al. (2011). *Industrial & Engineering Chemistry Research* 50(11): 6517-6527.

[4] 1.Webster, D. C. (2003). *Progress in Organic Coatings* 47(1): 77-86.



Most interesting pathway to synthesize NiPU is the polyaddition bifunctional cyclocarbonate and amine building-blocks. Compare to common synthesis of PU, the advantages of NiPU are (i) a limited use of harmful precursors (neither isocyanate nor phosgene are needed as reactants) and (ii) the precursors (cyclocarbonates and amines) are not sensitive toward moisture which limit the well-known side reactions impacting PU synthesis.

Figovsky et al.[5] enumerated a chronological complete list of patents and applications in the field showing the interest of leading companies to commercialize this technology. SPECIFIC POLYMERS produces and sells a wide range of cyclocarbonates building-blocks and master corresponding synthesis pathway consisting in the carbonatation of epoxy counterparts.

Non-isocyanate biobased PolyUrethane

Within SPECIFIC POLYMERS, we are also aiming the development of Non-isocyanate biobased PolyUrethane (NibPU) materials to address sustainability issues besides reducing product toxicity. In the field of biobased epoxy materials, a range of biobased epoxidized vegetable oils or aromatic resins for epoxy materials has been developed. Thanks to an in-depth understanding used precursors and the development of robust epoxydation/glycidylation pathways, it was possible to reach epoxy resins characterized by various structures and epoxy content and thus to tune the mechanical properties of corresponding epoxy materials by mastering the crosslinking density. Glass transition temperature from -25°C to 180°C are reachable using our biobased epoxy precursors. All these epoxy resins can be modified into biobased cyclocarbonates building-blocks of interest for the development of innovative build-to-spec. NibPU materials. Green chemistry is a fundamental aspect of SPECIFIC POLYMERS' activity and many projects are ongoing to find biobased and nontoxic innovative alternatives to fossils resources.

