

SUSTAINABLE POLY(HYDROXYURETHANE) S THERMOSET ADHESIVES FOR AFFIXING METALS

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In the last 5 years, isocyanates-free polyhydroxyurethanes (PHUs), synthesized by step-growth polymerization between biscyclic carbonates and di- or poly-amines, have emerged as a novel class of polyurethanes (PUs). These PHUs find promising applications in flooring, paints, as thermoset materials or (thermal insulation) foams. PHUs can be also exploited advantageously for designing the next generation of high performance polyurethane adhesives. Thanks to the presence of pendant hydroxyl groups favouring the polymer/substrate interactions, the adhesion performances of PHUs may equal or even surpass the ones of conventional PUs. In this contribution, we focused on the design of novel reinforced bio- and CO₂-based PHU thermosets adhesives with high shear adhesion strength for metal substrates (aluminium and stainless steel). The research included [I] The synthesis of a library of bi- or multifunctional 5-membered cyclic carbonates by coupling CO₂ with (bio-based) epoxidized precursors using a novel home-made binary organocatalyst highly performant under very mild experimental conditions. 3–7 [II] The development of solvent-free reinforced PHU thermoset adhesives⁸ from various cyclic carbonate/amine/functional fillers formulations. For all formulations, curing kinetics were monitored by rheology to determine the gelation time and the thermo-mechanical and physico-chemical properties of PHUs were evaluated on free-standing films [III] The evaluation of the adhesives performances for metal sticking:⁸ The adhesion of (reinforced) PHUs onto Al-2024-T3 or stainless steel substrates was evaluated by standard cross-cut adhesion (5B) and MEK double rubber (> 300) tests and shear adhesion strength (> 16 MPa).

BIOGRAPHY

Satyannarayana Panchireddy received his MSc. degree from University of Hyderabad, India, in 2012. He works as research assistant (DR-DO-Junior Research Fellow) on synthesis of norbornene derived polymers at Indian Institute of Science Education and Research-Kolkata (IISER-K), India, in 2012-13. He moved to KU Leuven, Belgium, in 2014-15, to work as research associate on polyelectrolyte thin film membranes. He is currently PhD Researcher under supervision of Prof. Christine Jerome, and Dr. Christophe Detrembleur at Laboratory of Center for Education and Research on Macromolecules (CERM), University of Liège, Belgium, 2015-. His current research focus on the synthesis and development of novel sustainable non-isocyanate polyurethanes for innovative applications as coatings and adhesives for automotive, aerospace, electronics, footwear, pharmaceuticals etc.

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